

6-50157

document concerning a letter of TSN  
requirements described as "upland"  
Finally, under with attachments

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Mr. Rodger Field  
Associate Regional Counsel  
U.S.EPA  
230 South Dearborn  
16th Floor  
Chicago, Illinois 60604

Dear Rodger:

Enclosed is the document you requested concerning a waiver of certain TSCA requirements which you have described as the "upland facility" waiver. In light of the unique and apparently unprecedented nature of this request, both in terms of resolution of the issue between OMC and EPA and the regulations themselves, we have made our best effort at addressing those issues involved and providing EPA with technical information to support such a determination. OMC is prepared to discuss any question, request or comment you may have and assumes that EPA would share these comments with us.

OMC also assumes that you and EPA will treat this submission as confidential in light of the settlement discussions in which this document has been prepared and is now submitted.

Very truly yours,

  
JEFFREY C. FORT

JCF:je  
Enclosure



OUTBOARD MARINE CORPORATION

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June 30, 1987

Mr. Valdas V. Adamkus  
Regional Administrator  
United States Environmental  
Protection Agency  
Region V  
230 South Dearborn Street  
Chicago, Illinois 60604

Re: Outboard Marine Corporation-Waukegan Harbor Site

Dear Mr. Adamkus:

This letter is submitted pursuant to our April 22, 1987, meeting, and to the meeting between representatives of Outboard Marine Corporation ("OMC") and Region V, U.S.EPA, on December 1, 1986. These and other meetings have occurred in an effort to resolve the matter between Outboard Marine Corporation and EPA concerning what remedial action is appropriate for the Waukegan Harbor NPL site. This request is submitted at this time only for the purpose of settlement negotiations and therefore should be treated as a confidential document. This request is not intended as a response to the recently received comments of your staff on the risk assessment prepared by K. S. Crump, et al.

At the meeting on April 22, 1987, to discuss the technical details of the in-place containment (IPC) option, EPA representatives indicated that OMC should apply for a "waiver" of certain Toxic Substance Control Act regulations in order to resolve the matter based on the IPC proposal. Your staff indicated this request was needed to address the "alternative upland disposal site" issue under 761.60(a)(5). After review of the TSCA

Mr. Valdas V. Adamkus  
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regulations and consideration of the available data, OMC believes that the IPC approach may be authorized by you as a chemical waste landfill under \$761.75, and therefore meets \$761.60(a)(5)(ii). We also believe this letter and the referenced documents satisfy the request made of OMC in the April 22 meeting and demonstrate that no upland disposal facility is available.

Based on the above, Outboard Marine Corporation hereby requests a waiver from the requirement that a PCB landfill be 50 feet above the groundwater table, as contained in \$761.75(b)(3), pursuant to \$761.75(c)(4), for the reasons referenced below. This request is based upon various data and other information submitted by Outboard Marine Corporation to EPA. The following studies are either incorporated by reference or attached, and should be deemed to be part of this request.

- 1) Remedial Action Plan, Waukegan Harbor, dated December 1, 1986.
- 2) K. S. Crump, et al., "Summary of Risk Assessment on Polychlorinated Biphenyls for Outboard Marine Corporation Site" (January 13, 1987).
- 3) K. S. Crump, et al., "Risk Assessment on Polychlorinated Biphenyls for Outboard Marine Corporation Site, Final Report" (February 26, 1987).
- 4) John E. Herbich, "Dredging Efficiency and Resuspension of Sediment" (October, 1986). (Attachment A)
- 5) Golder Associates, "Inplace Containment Alternatives, Outboard Marine Corporation" (June, 1987). (Attachment B)
- 6) "Waukegan Harbor, Illinois, Confined Dredged Disposal Facility Site Selection Study" (Chicago, Illinois: Corps of Engineers, April, 1984), (Attachment C) and Letter to Hugh Thomas from Frank R. Fitch, dated September 20, 1984, and the enclosed "Deauthorization of Corps of Engineers Project: Waukegan Harbor, Illinois, Project Modification." (Attachment D)

In addition, the information provided to EPA and the State at our September 30 meeting should also be considered. Minutes of the technical information presented at that meeting are also attached. (Attachment E)

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### I. Regulatory Authority

EPA regulations for the disposal of dredged spoil containing polychlorinated biphenyls are contained in 40 CFR §761.60(a)(5). This section requires disposal: in a chemical waste landfill qualifying under 761.75; in an approved incinerator; or by an alternate disposal method.

OMC submits that the IPC alternative meets the goals of the regulations and provides engineering protections equivalent to the requirements contained in 40 CFR §761.75(b) for chemical waste landfills. OMC submits that the referenced documentation demonstrates that "operation of the landfill will not present an unreasonable risk of injury to health or the environment . . .," under 40 CFR §761.75(c)(4). Therefore, a waiver is appropriate to allow the implementation of IPC under the TSCA regulations.

### II. Conclusions Concerning the IPC Proposal

In support of these requests and determinations, Outboard Marine suggests the following findings are appropriate and confirmed by the available evidence:

(A) Dredging and handling of PCB material should be minimized. The IPC proposal avoids the increased levels of PCBs that would be released to the environment by any attempt to excavate PCBs, particularly by attempting to dredge PCBs from Slip 3 of Waukegan Harbor.

The concentration of PCBs in contact with the water column will be much greater after dredging than it is at present, since substantial burial of the contaminated sediments has already occurred at this site. An analysis by Dr. Herbich concluded that PCBs will be resuspended in the water column by the dredging process. Dr. Herbich estimated that at least 2,139 lbs. of PCBs will be resuspended by use of a cutter-head dredge, and about 12,700 lbs. of PCBs by a clam-shell dredge method. Additional sediment losses will occur during the dredging process because of leaks in pumps, pipeline joints, and other facilities. Furthermore, Dr. Herbich concluded that the sediment-dredging operation can be expected to be no more than approximately 87 percent effective under ideal conditions and in reality may well attain removal efficiencies of only 60 percent.

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The removal of PCB sediments from Waukegan Harbor will result in greater handling of contaminated sediments than the IPC alternative. This handling will create additional environmental risks, and will unnecessarily increase the cost and engineering uncertainties involved in any remedial plan. The cost of the ROD-selected remedy is presently estimated at near 30 million dollars; the estimated cost of the IPC remedy is less than 15 million dollars.

(B) There is no "available upland disposal facility". Your staff has indicated an interest in alternative locations for disposal of PCB materials from the Site. Any remedial action to dispose of PCB materials, other than under the IPC approach, involves multiple handling, releases of PCBs, and associated costs. For this reason alone, EPA should conclude there is no "available upland disposal facility". In addition, considering other technical, economic and environmental factors discussed below, no upland disposal facility is available for disposal of PCB-contaminated sediments and soils from the Site.

The property owned by Outboard Marine Corporation is not available, based upon technical, economic and environmental considerations. Removal of PCBs from Slip 3 and the Harbor will, in fact, increase the amount of PCBs released to the Lake and available to the environment. De-watering facilities, such as those identified in the Record of Decision, will create a risk to OMC's continued business operations, such as sensitive computer and data processing facilities, the product research engineering facilities, scheduling of deliveries and shipments from OMC's production facilities, and disrupt parking and other OMC activities. Such dredging, de-watering and disposal facilities will also create an increased risk to the public (who use the adjoining beach) and deprive the public of access to the harbor for boating. Moreover, EPA's prior action in the Record of Decision suggests that this property is not "available" because no chemical waste landfill constructed at that location could comply with all the requirements for a PCB chemical landfill. Finally, it is the opinion of Golder Associates that the IPC approach is a more secure remedial action than construction of an above-ground vault.

Off-site disposal of PCBs from the Site at any existing or new landfill in Illinois would require approval of the local municipal government and the Illinois Environmental Protection Agency. Any such approval would require extensive public hearings

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and lead to lengthy administrative and judicial appeals. The likelihood of receiving such approval is doubtful. Even if it could be obtained, the process would take many years. EPA has already experienced these issues, for example, in the Bloomington, Indiana, and Hudson River, New York, projects. Lack of public support for such upland disposal was a reason the Corps of Engineers found that there was no available upland disposal area even for slightly contaminated sediments. (See Attachment D.)

Off-site disposal, at the nearest existing PCB chemical landfill, would require extensive transportation. The risk of a fatality associated with merely transporting the materials, defined by the Record of Decision to be from "hot spot" areas, to Cincinnati, Ohio, is greater than the risk of taking no action at the Site. Other risks would include PCB releases due to spills en route and releases at the disposal site. Thus, off-site disposal poses a greater risk than the IPC approach, and is not an available disposal option.

(C) The conceptual plan of the IPC is an equivalent alternative disposal method. The IPC alternative is effective in preventing the transport of PCBs from Slip 3 to the environment and ultimately in reducing sediment, water and fish concentrations of PCBs. The risk to human health resulting after implementation of IPC is much less than the risk of the remedial action recommended in the Record of Decision. The IPC Remedial Action Plan meets the goals and environmental criteria for chemical waste landfills under 40 CFR §761.75. The Plan is at least an equivalent environmental and engineering approach to the requirements for a PCB chemical waste landfill.

Additionally, the facility as proposed will be protective of human health and the environment. This conclusion is based on the independent conclusion of the risk assessment by Dr. Crump, et al. Moreover, the enclosed report by Golder Associates makes these conclusions concerning IPC:

1. The proposed remedial alternative differs from that specified in the ROD in that the spoil dredged from the Upper Harbor will be contained in Slip No. 3. The consequence of this alternative is that release of PCBs to the environment by volatilization and as a result of the dredging operation will be reduced.
2. The proposed action also differs from the ROD alternative in that it provides for a

permanent in-place water withdrawal and treatment system for all containments to actively control, as required, water levels in the containment areas and, hence, create an inward gradient, thereby preventing aqueous movement of PCBs from the containments.

3. The in-place containment in Slip No. 3 satisfies all of the TSCA requirements for a chemical waste landfill, with the exception of the requirement for a 50 foot separation between the liner system and the groundwater table. However, analyses of the possible contaminant transport mechanisms, together with the expected PCB mass loading rates, indicate that a waiver of this requirement is appropriate. Such a waiver will not present an unreasonable risk of injury to health or the environment from PCBs.
4. The requirement for flood protection is not considered to be directed at closed landfills.
5. Evaluation of the IPC alternative, based on available data, demonstrates that it is technically feasible and effective. Even if site specific data establish that strong vertical gradients exist at the site and that it will be difficult to maintain a uniform inward gradient across the containment, the consequences are minimal enough to be considered insignificant.
6. Additional data are required to design the remedial alternative and to quantitatively address some aspects of the containment effectiveness. These data include:
  - site specific potentiometric levels;
  - properties of the various soil strata;
  - water quality data in the Silurian Aquifer;
  - background groundwater quality data.

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Letter from K. P. Akins, Jr., and R. S. Williams, Golder Associates, to J. Fort, dated June 24, 1987 (Attachment B cover letter).

The plan poses less of a risk to human health and the environment, at a lower cost, than the Agency's announced plan for remediation.

### III. Acceptable Conditions for the Waiver

The regulations provide that the Regional Administrator may impose certain conditions on the granting of any waiver. The IPC proposal, as embodied in the December 1, 1986, document, outlines certain investigations that must be performed; OMC stands willing to proceed with these investigations to finalize the design and implementation details.


### IV. Conclusion

Based upon these facts and the referenced documents, Outboard Marine Corporation requests that the Regional Administrator determine that the proposed in-place containment remedy, as outlined in the documents dated December 1, 1986, be deemed to be a remedial action compliant with the requirements of the Toxic Substance Control Act PCB-disposal regulations in 40 CFR §761.60(a)(5) and §761.75.

OMC is prepared to provide additional information or to discuss this request, and the details of the Remedial Action Plan, with you and your staff. OMC also expects to forward a reply to your staff's comments on the risk assessment in the near future.

Respectfully submitted,

OUTBOARD MARINE CORPORATION

BY   
J. Roger Crawford  
Corporate Director,  
Environmental Control

JRC:je  
Attachments

**A**

DREDGING EFFICIENCY  
AND  
RE-SUSPENSION OF SEDIMENT

Prepared  
by  
John B. Herbich, Ph.D., P.E.

Prepared  
for  
Martin, Craig, Chester & Sonnenschein  
Chicago, Illinois

Report No. JBH-1981-28

October 1986

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# DREDGING EFFICIENCY AND RE-SUSPENSION OF SEDIMENT

## INTRODUCTION

Polychlorinated biphenyls (PCBs) have been found in Waukegan Harbor and in the North Ditch/Parking Lot Area. Waukegan Harbor is an irregularly-shaped harbor (Figure 1) about 37 acres in area. According to Conceptual Design (EPA 13-5M28.0, September 14, 1984) the harbor has been divided into three general areas of PCB contamination:

- a) Slip No. 3 - concentrations in excess of 500 parts per million (ppm),
- b) the Upper Harbor - concentrations from 50 to 500 ppm, and
- c) the Lower Harbor - concentrations from 10 to 50 ppm.

Water depths in the harbor generally vary from 14 to 25 (ft), with some shallower depths in parts of Slip No. 3. The extent of Federal Project dredging is shown in Figure 2.

The harbor sediments consist of 1 to 7 ft of very soft organic silt (muck) overlying typically 4 ft of medium dense, fine to coarse sand. A very stiff silt (glacial till) that typically ranges from 50 to more than 100 ft thick underlies the sand. The entire harbor is bordered by 20- to 25-ft long steel sheet piling. The sheet piles are believed to generally extend into the sand layer above the glacial till.

## ALTERNATIVE DREDGING METHODS FOR REMOVAL OF PCBs

About twelve different types of dredging equipment were considered for the removal of sediment contaminated with PCBs from Slip No. 3 at the Waukegan Harbor. The most efficient equipment includes a cutterhead dredge, a plain suction dredge, a dustpan dredge and a Pneuma dredge. A clamshell

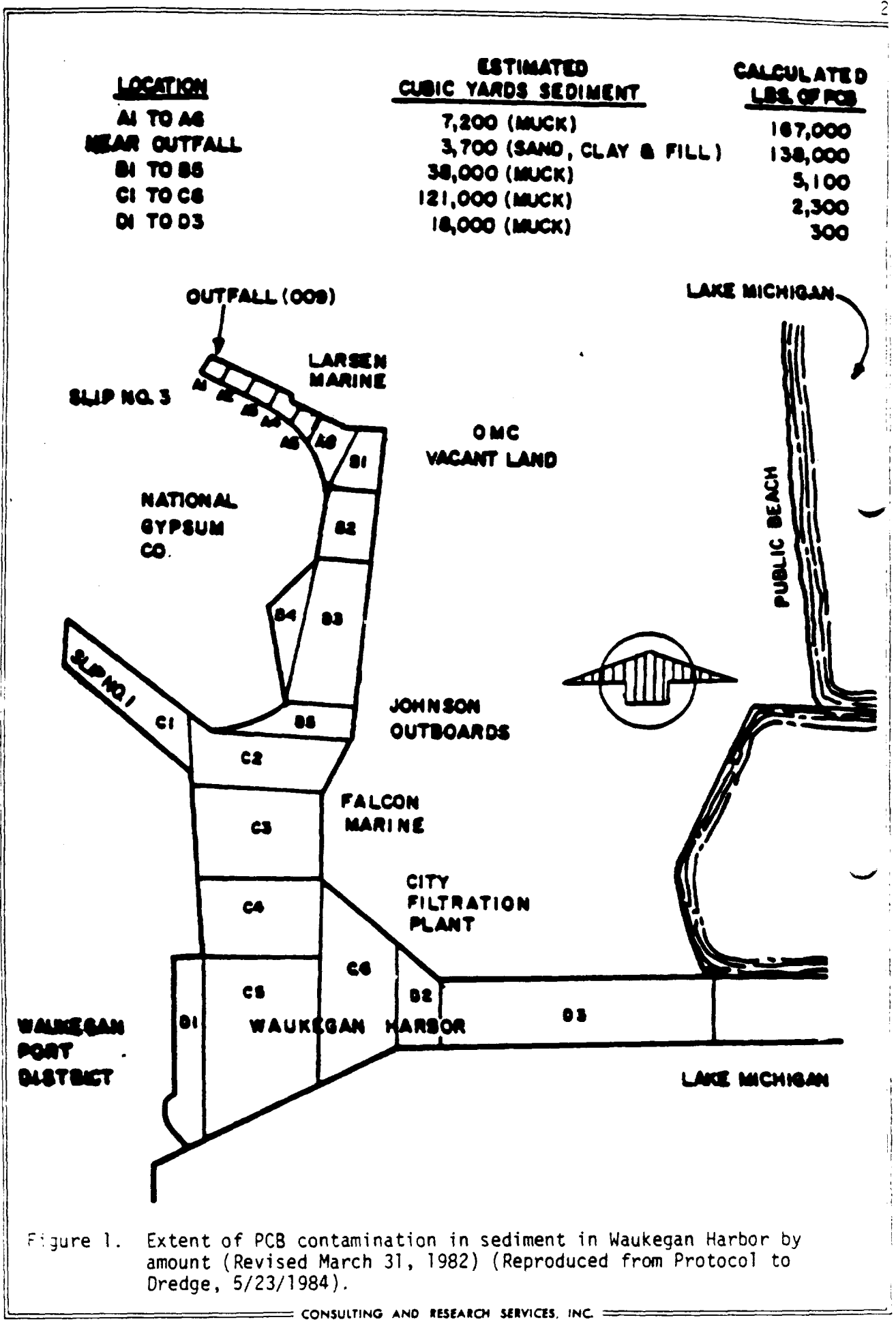


Figure 1. Extent of PCB contamination in sediment in Waukegan Harbor by amount (Revised March 31, 1982) (Reproduced from Protocol to Dredge, 5/23/1984).

Figure 2. Extent of Federal Dredging Project.

dredge was also evaluated since it was specifically mentioned in the Conceptual Design report (p. 2-7).

## 1. CUTTERHEAD DREDGE

### *Principle of Operation*

The cutterhead suction dredge is a very versatile and best-known dredging vessel. It differs from the dustpan dredge in that it is equipped with a rotating cutter apparatus surrounding the intake end of the suction pipe. Dredge pumps move the material loosened, or cut by the cutter, and discharge it through a pipeline at the disposal area.

### *Experience*

The most commonly used type of dredge for construction of new channels or maintenance of existing channels and for general subaqueous excavation.

### *Turbidity*

The turbidity of the water samples can be analyzed in terms of

- a) suspended solids, in milligrams per liter,
- b) Jackson turbidity units,
- c) nephelometric turbidity units (NTU),
- d) transmission, percent.

Huston (1976) conducted measurements of turbidity created by a cutter-head dredge. Table 1 indicates the turbidity readings in three different cutter speeds. Table 2 shows the background water data taken 1200 ft from the dredge. Table 3 compares the three turbidity unit measurements for background water 240 ft from dredge.

Huston concludes that the turbidity data shows several trends:

- a) The transmission and scattering data in most cases show an increase in turbidity above background levels only in the immediate vicinity

Table 1

Turbidity at Different Cutter Speeds

## CUT NO. 1 - 20 feet

Depth of Sample	10 rpm			20 rpm			30 rpm		
	%T	Mg/l	NTU	%T	Mg/l	NTU	%T	Mg/l	NTU
3	55	26	8	70	22	6	72	154	4
9	65	89	10	65	12	6	68	91	4
18	42	161	43	5	187	44	24	580	45

## CUT NO. 2 - 30 feet

Depth of Sample	10 rpm			20 rpm			30 rpm		
	%T	Mg/l	NTU	%T	Mg/l	NTU	%T	Mg/l	NTU
3	47	114	3	56	-	7	66	106	4
10	41	64	9	45	46	7	65	80	5
20	44	102	15	38	-	8	50	11	15
30	17	55	14	5	37	37	4	208	26

## CUT NO. 3 - 40 feet

Depth of Sample	10 rpm			20 rpm			30 rpm		
	%T	Mg/l	NTU	%T	Mg/l	NTU	%T	Mg/l	NTU
3	54	144	3	55	75	5	66	125	4
10	48	150	10	58	-	6	66	72	8
20	52	25	7	60	165	10	63	56	9
30	30	-	5	47	94	8	26	138	22
40	7	52	12	24	176	30	2	266	57

Table 2

Background Water Data

Depth Feet	Temp Deg C	Sal ppt	DO ppm	T %	Tide		pH
					Knots	Dir	
1	27.76	27.60	5.8	68			8.6
10	28.26	27.20	5.7	72	0.25	N90°E	8.6
20	27.00	28.20	5.7	64	0.25	N90°E	8.4
30	27.82	27.80	5.3	60	0.40	N90°E	8.0
40	27.80	27.60	4.2	46	0.40	N90°E	8.0

Wind = 18-20 knots Direction = N30°E Weather = fair, cldy  
 Sea state = 1 ft. Air Temp = 25.50C. Tide Hi: 0209; 1024  
 Time = 1130 Lo: 0731; 1839

Data taken 1200 feet easterly from dredge, in center of channel

Table 3

Comparison of Three Turbidity Unit Measurements for  
Background Water near Dredge

Depth of Sample (feet)	NTU	%T	Mg/l
3	6	72	94
10	8	71	77
20	8	69	168
30	4	65	39
40	9	50	50
45	14	44	209

Note: Samples taken in channel approximately  
 240 feet starboard of dredge

of the cutter (the deepest measurement). The increased levels of turbidity around the cutter are probably due to the suspension of fine-grained material created by turbulence generated by the cutter.

- b) In spite of turbidity generated by the cutter, the turbidity in the upper water column above the cutter (including all measurements except the deepest ones near the cutter) is usually comparable to those background levels measured 240 feet from the dredge. Reversals in turbidity readings in the upper part of the water column, similar to those reversals seen in the background data, are probably due to background variability. Apparently little of the turbidity created by the cutter went into the upper water column, especially from depths of 30 or 40 feet. This is also supported by the fact that no substantial visible surface turbidity was ever observed.
- c) Although the turbidity data collected in the immediate vicinity of the cutter are quite variable, probably due to cutter-generated turbulence, there also may be a general, but inconsistent, increase in turbidity with increasing rpm. This inconsistency may be due to cutter-generated turbulence, variability in material being dredged, and/or suction velocity.

At other locations the re-suspended sediment concentrations varied from 158 mg/l (Upper Mississippi) to 303 mg/l (Cumberland River).

A relationship between suspended solids and relative production is shown in Figure 3.

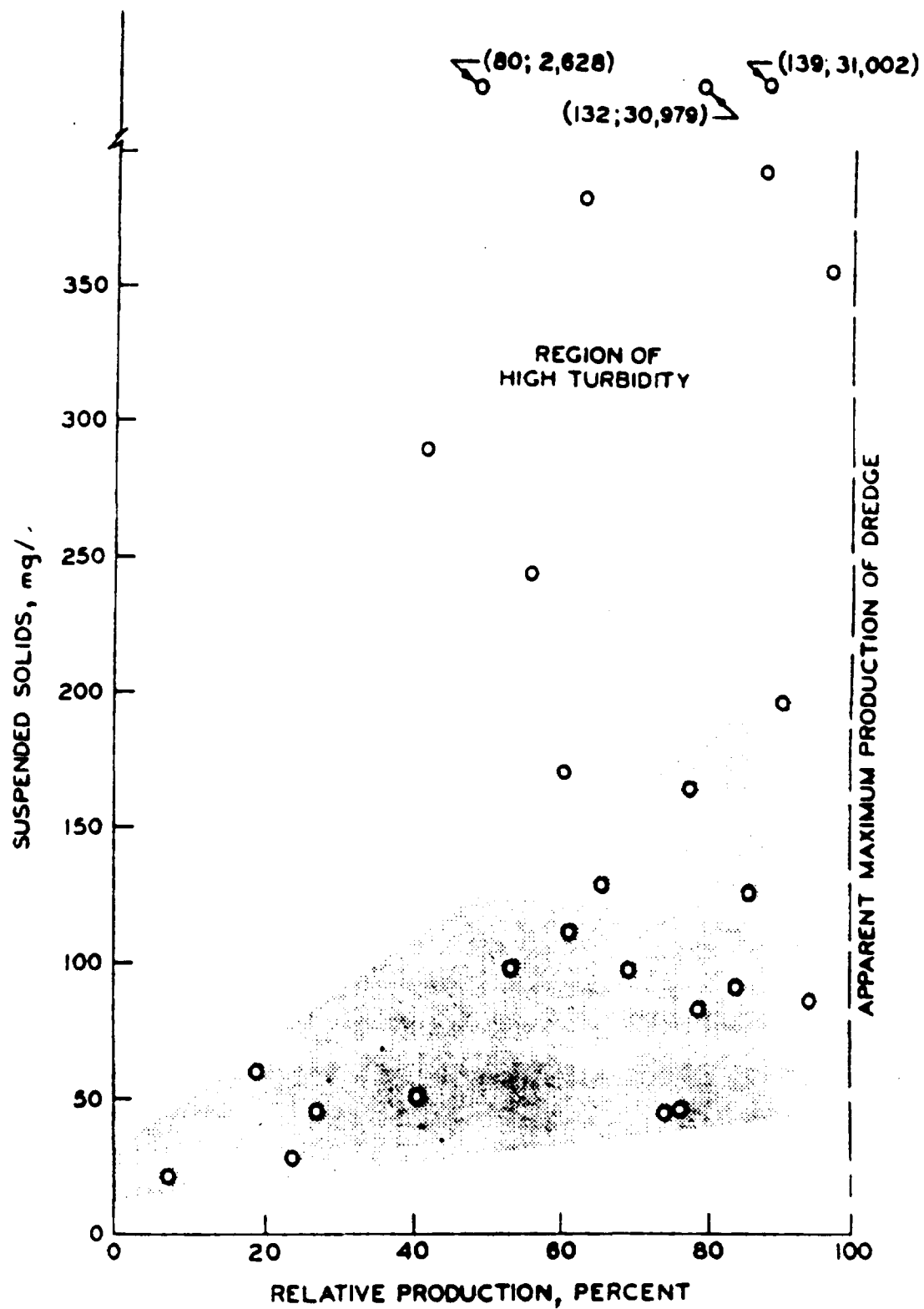


Figure 3. Relationship between the concentration of suspended solids 1 m from the cutter and the relative production of a 61-cm (24-in.) cutterhead dredge

## 2. PLAIN SUCTION DREDGE

### *Principle of Operation*

The plain suction dredge is the simplest of the hydraulic suction dredges. It employs a long suction pipe to dig and lift the material to the surface. This dredge, however, works best in free flowing sand where gravity can feed the suction pipe. Digging may be supplemented by waterjets at the suction pipe mouth. Though these dredges can be used where they can remain stationary for long periods of time and are usually not self-propelled, they are designed to work in moderate swells and even in storm conditions. Individual dredges may be designed either to load their own hoppers, to load barges, or to pump through a pipeline.

### *Experience*

This dredge is quite useful to beach nourishment programs. Though plain suction dredges possess offshore capabilities they are, however, suited for projects having free flowing, thick sand deposits.

### *Turbidity*

Operating in free-flowing sand, a plain suction dredge usually causes little solids suspension. The use of water jets can create significant turbidity at the bottom. Turbidity at the surface can occur due to overflow of sediment-laden water from hoppers or barges. The turbidity generated by a plain suction dredge should be less than that caused by a cutterhead dredge because there is no rotating cutter.

### 3. DUSTPAN DREDGE

#### *Principle of Operation*

In the Dustpan dredge the suction head resembles a large vacuum cleaner or dustpan. The Dustpan dredge is a hydraulic, plain suction, self-propelled dredge. It consists essentially of a dredge pump which draws in a mixture of water and dredged materials through the suction head. The suction head is about as wide as the hull of the dredge and is fitted with high velocity water jets for agitating and mixing the material. The dredge can pump the slurried material to a disposal area. The Dustpan dredge is suitable only for high volume granular material.

#### *Experience*

Dustpan dredges have been developed and almost exclusively used in the United States. The Army Corps of Engineers has extensively used such dredges for deepening the Mississippi River. They are also being used in South America and Europe.

#### *Turbidity*

There is little turbidity for free-flowing sand but significant turbidity is expected at the bottom due to water jets.

#### 4. GRAB/BUCKET/CLAMSHELL DREDGES

##### *Principle of Operation*

The grab, bucket, or clamshell dredge consists of a bucket or clamshell operated from a crane, or derrick mounted on a barge or on land. It is used extensively for removing relatively small volumes of material, particularly around docks, piers, or within restricted areas. The clamshell dredge usually leaves an irregular, cratered bottom.

##### *Turbidity*

The turbidity generated by a typical clamshell operation is high and can be traced to four major sources:

- a. sediment resuspension occurring when the bucket impacts on and is pulled off the bottom.
- b. the surface material in an open bucket is rapidly eroded as the bucket is pulled up through the water column.
- c. further loss of sediment is experienced when the bucket breaks the water surface.
- d. turbid water leaks through the openings between the jaws.

Field tests indicate the concentrations of re-suspended sediment in amounts varying from 30 to 500 milligrams/liter (mg/l). The following measurements were obtained and reported:

<u>Location</u>	<u>Re-suspended Sediment</u>
San Francisco	200 mg/l
Connecticut	168 mg/l
Maryland	30 mg/l
Japan	150-30 mg/l
Japan	500 mg/l (maximum)

## 5. WATERTIGHT CLAMSHELL

### *Principle of Operation*

To minimize the turbidity generated by a typical clamshell operation, the Port and Harbor Institute, Japan, developed a watertight bucket that seals when the bucket is closed (Figure 4). In addition, the top of the watertight bucket is covered so that the dredged material is totally enclosed within the bucket.

### *Experience*

According to the manufacturer these buckets are best adapted for dredging fine-grained, soft mud.

### *Turbidity*

A direct comparison of a 1 cubic meter typical bucket with a watertight clamshell bucket indicates that watertight buckets generate 30 to 70% less turbidity in the water column than the typical buckets.

Measurements made 10 meters downstream from a 4 cubic meter watertight clamshell dredge excavating fine-grained material from a depth of 8 meters indicated that the maximum suspended solids concentrations were approximately 500 mg/l, or less throughout the water column relative to background levels of 50 mg/l or less. Near-bottom and mid water column suspended solids levels were greater than surface levels, indicating that resuspension of bottom material near the clamshell impact point is probably responsible for most of the material suspended in the lower portion of the water column.

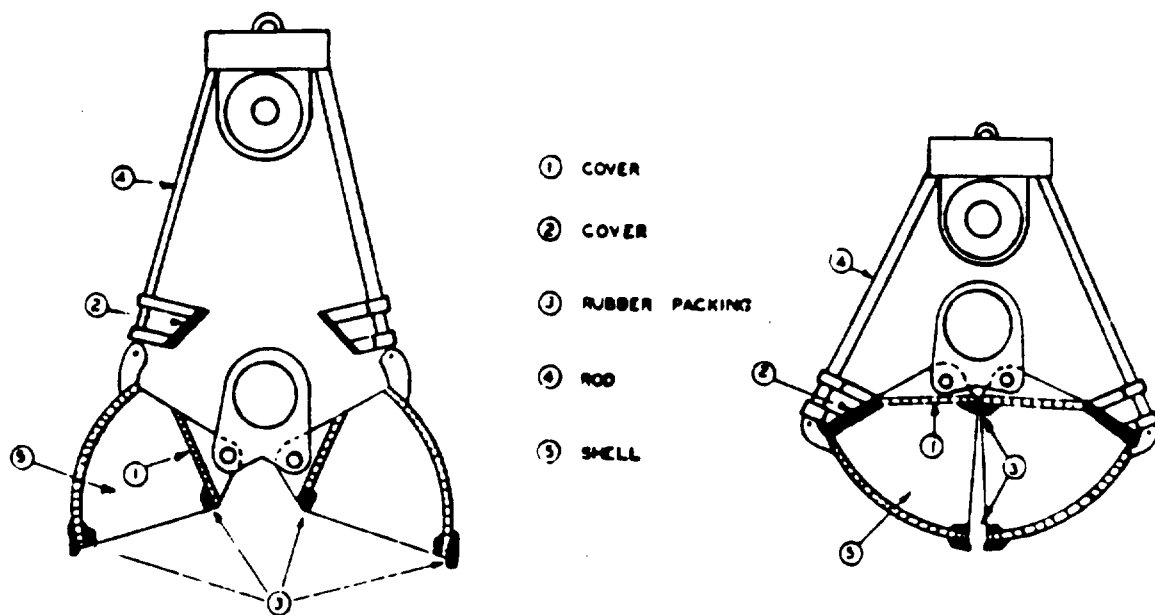


Figure 4. Open and closed positions of the watertight bucket

## 6. PNEUMA PUMP (Model 600/100)

### *Principle of Operation*

The PNEUMA pump is a compressed-air-driven, displacement-type pump with several major components. The pump body (Figure 5), the largest of these components in dimensions and weight, incorporates three large cylindrical pressure vessels, each having a material intake on the bottom and an air port and discharge outlet on top. Each intake and discharge outlet is fitted with a check valve, allowing flow in one direction only. Pipes leading from the three discharge outlets join in a single discharge directly above the pressure vessels. Different types of attachments may be fitted on the intakes for removal of varying types of bottom material.

The operation principle of the pump body is illustrated in Figure 6. When dredging, the body is placed on the bottom with material intakes buried. Venting an air port to atmospheric pressure causes flow into a material intake driven by ambient water pressure. This continues until the pressure vessel is nearly full, at which time compressed air enters the pressure vessel through the air port. The compressed air forces material out of the pressure vessel through the discharge outlet and on to its final destination. The pressure vessels are operated so that filling/emptying cycles are out of phase but overlap enough to minimize discharge surging.

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<sup>1</sup>"Pumping Performance and Turbidity Generation of Model 600/100 Pneuma Pump," by T.W. Richardson, et al., Technical Report No. HL-82-8, Prepared for Office, Chief of Engineers, U.S. Army, April 1982.

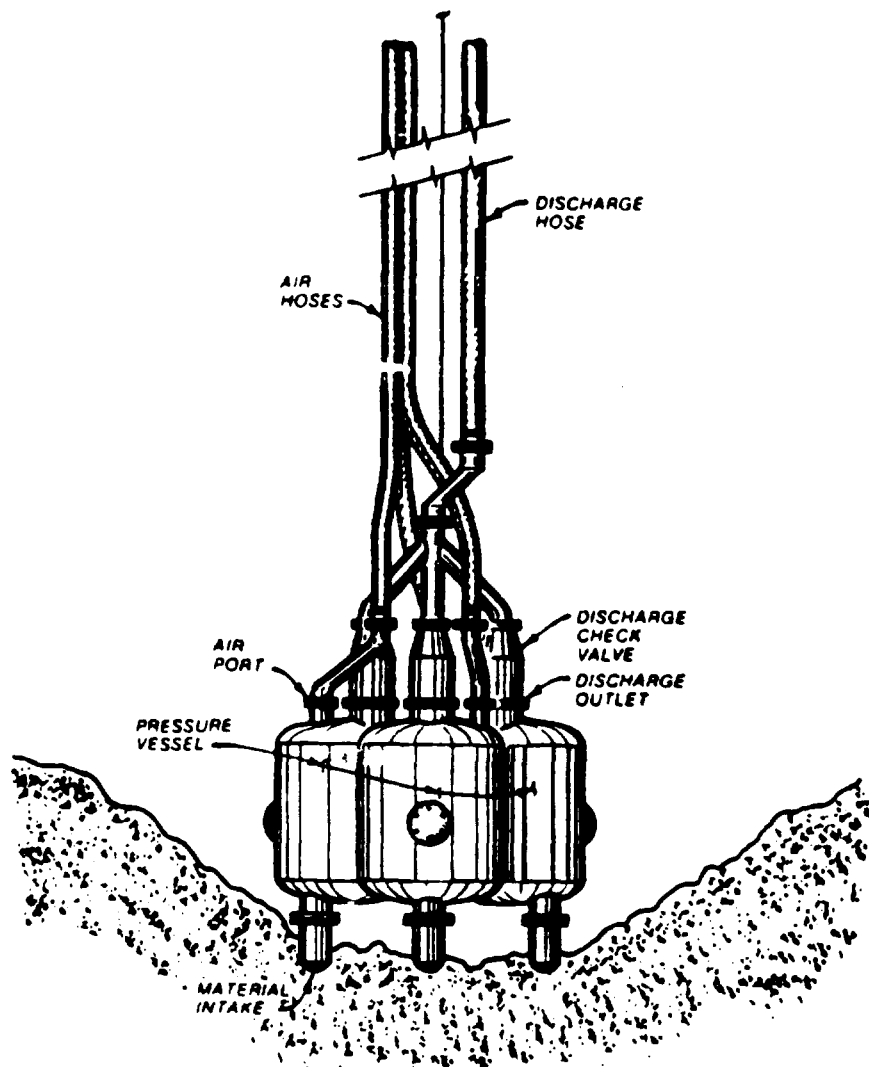


Figure 5. PNEUMA pump body

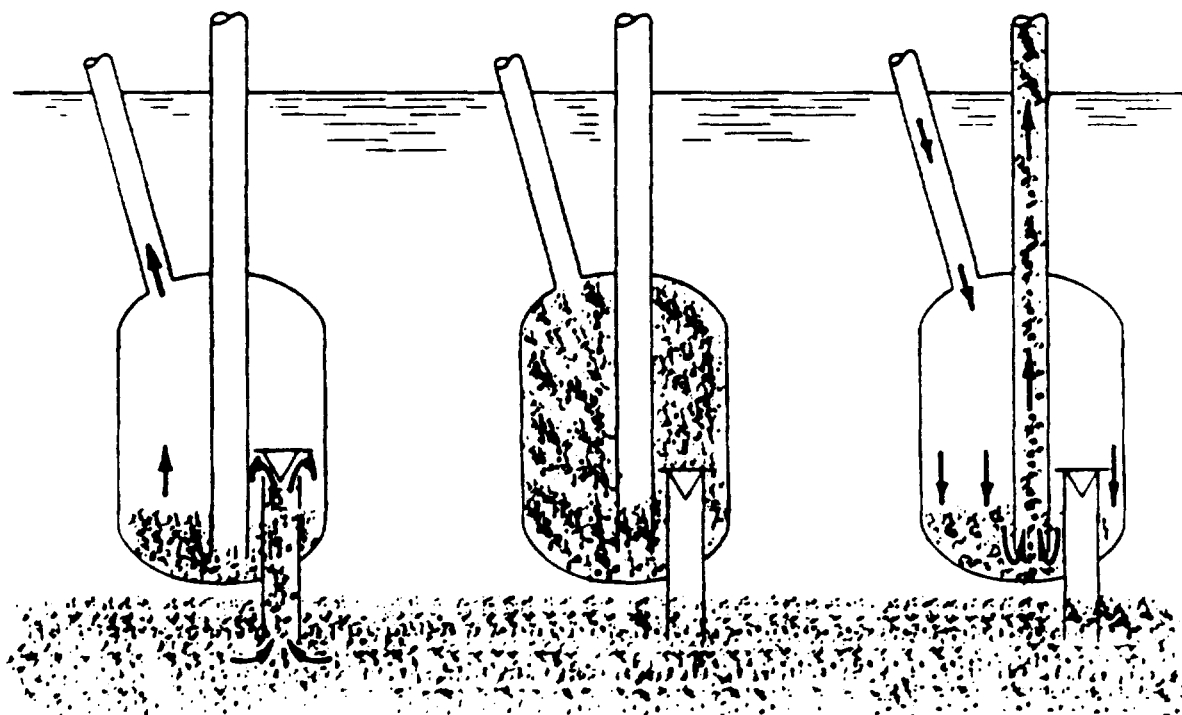


Figure 6. PNEUMA pump principle of operation

Timing and rate of pressure vessel cycles are controlled by an electrically driven air distributor (Figure 7). The heart of this device is a multiported spool valve rotated at a variable rate. Compressed air entering the valve is directed to a pressure vessel air port, while simultaneously another port is vented to the atmosphere. Variation of the valve rotational speed controls the pressure vessel cycle rate.

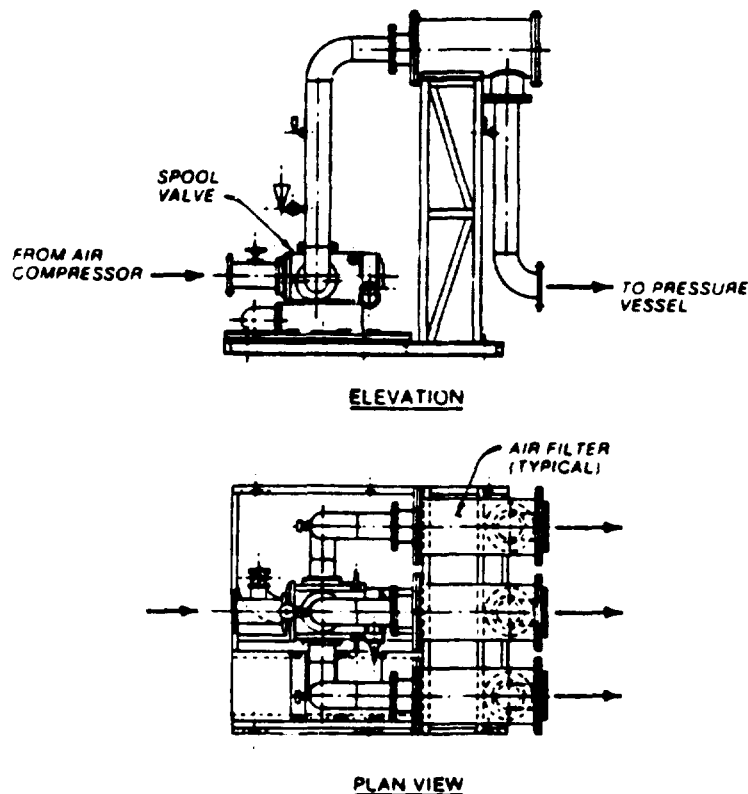


Figure 7. PNEUMA pump air distributor

The air distributor is connected to the pump body by three flexible hoses, each leading to a pressure vessel air port. A single flexible hose runs from the pump body discharge manifold back to the surface, where it connects to the surface discharge pipeline. The pump body and hoses are usually suspended by a harness from a crane or lifting frame, although other types of support are possible. Figure 8 shows a simple arrangement of all major pump components.

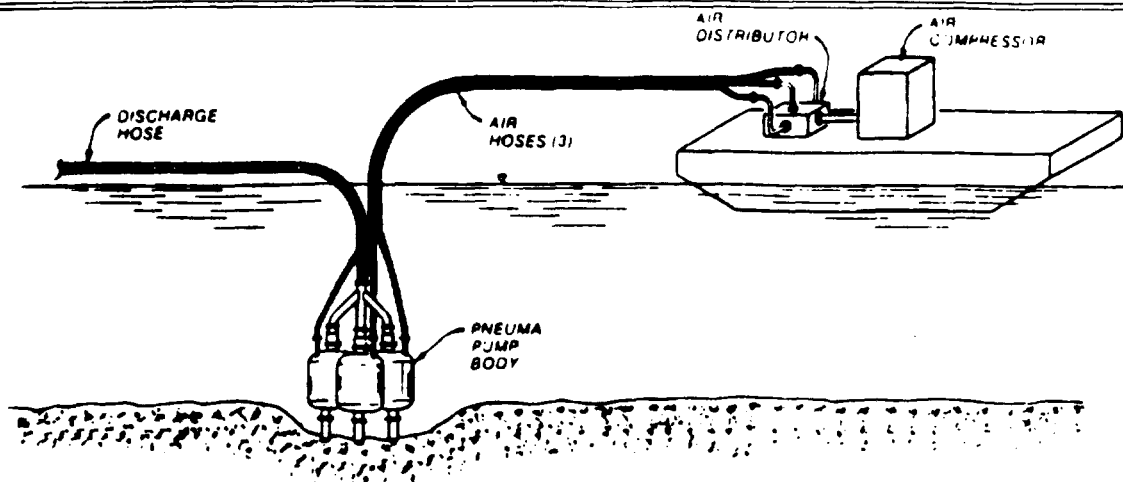


Figure 8. Major components of basic PNEUMA system

At the time of testing, the manufacturer produced six standard models of the PNEUMA pump. The pump tested was designated as Model 600/100. Figure 9 describes the pump body dimensions of standard models. Model 600/100 is one of the larger units, measuring 14.4 ft high by 12.2 ft in diameter and weighing 14,800 lb.

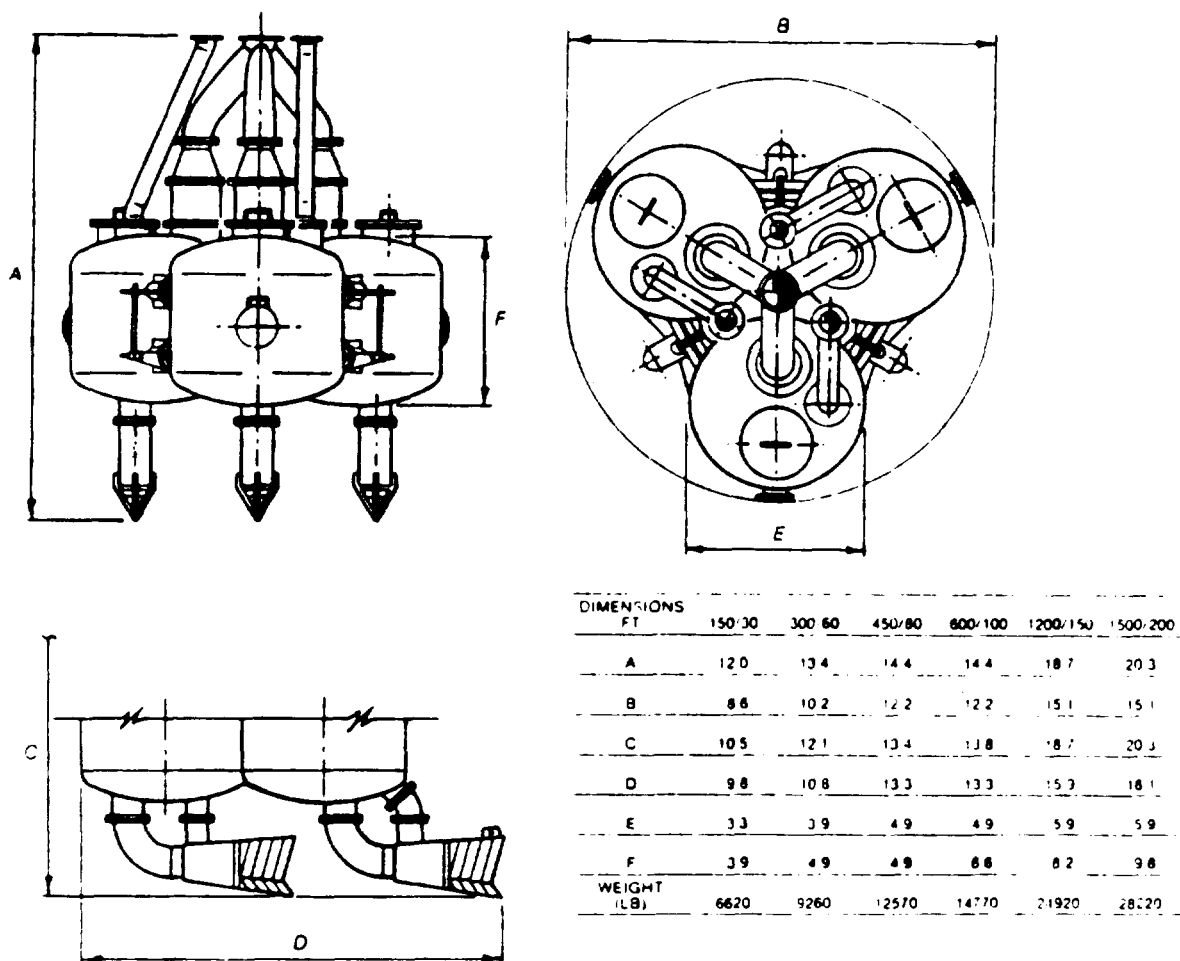


Figure 9. Pump body dimensions of standard PNEUMA models

### Pump Efficiency

One of the characteristics of PNEUMA pumps is their inefficiency as a pumping device compared with a centrifugal pump. Pump efficiency is usually defined as the ratio of output to input horsepower. A well-designed centrifugal dredge pump can achieve 80 percent efficiency. By contrast the PNEUMA pump was found to have efficiency between 8 and 12 percent. However, PNEUMA pump can perform tasks not achievable by other pumps and is generally used for removal of small volumes of sediments.

### Specific Gravity in the Discharge Line

The specific gravity in the discharge line of the pump varies cyclically due to the nature of the pump's operation. Consider the following:

"The volume of a pressure vessel for a PNEUMA 600/100 pump is approximately 100 ft<sup>3</sup>. Assume that 75 percent of this volume, or 75 ft<sup>3</sup>, is forced into the discharge line in each cycle at an average velocity of 10 fps. Then, in a 10-in. discharge pipe, it would take approximately 14 sec for the contents of one vessel to pass the nuclear density meter. Therefore, variations in pressure vessel contents would cause changes in discharge specific gravity at least every 14 sec."

The discharge may be described as "slug flow" and the density not only varies between slugs but also within each slug. Consequently the specific gravity in the discharge line while pumping sand was between 1.10 and 1.70. The specific gravities varied between 1.08 and 1.41 while pumping fine-grained sediments. The discharge densities of any significance could not be sustained longer than 15 minutes in either silty clay or sand.

### Discharge Velocity

The discharge velocities varied from 6 to 8 feet per second for a 2000 ft long discharge pipe to 13 to 14 feet per second for pipe, to 420 ft long discharge line.

---

\*Source: conversation with PNEUMA North America.

### Excavation Rate

Excavation rates in a location where the sediment was characterized as dark gray and black silty clay, in situ unit weight of 70.6 pounds per cubic foot was between 300 and 900 cubic yards per hour (median rate = 350 cubic yards per hour). This compares favorably with the median sand excavation rate of 185 cubic yards per hour.

### Turbidity Generation

The turbidity generation monitoring program was not very successful since the PNEUMA pump was discharging water or extremely dilute sediment.

Sample results for excavating in dark gray and black silty clay are shown in Table 4.

Time from Start (min)	Distance from the Pump (ft)	Turbidity (NTU)*		Suspended Solids (mg/l)	
		Maximum	Average	Maximum	Average
10	25	6.0	6.65	4.05	7.89
20	25	17.5	17.75	6.90	6.20
30	25	20.5	16.50	5.35	5.19
40	100	21.0	14.13	6.35	6.02
50	100	40.0	48.25	21.50	15.88
60	100	60.0	19.50	26.40	9.79
70	100	14.0	21.38	7.40	16.60
80	100	14.0	9.50	6.75	6.01
90	100	16.0	8.75	6.70	5.65

\*Nephelometric Turbidity Units (NTU)

TABLE 4. Measurements of turbidity generated by PNEUMA Pump.

Table 5 summarizes the approximate turbidity levels generated by different types of dredges.

Table 5. APPROXIMATE TURBIDITY LEVELS GENERATED BY DIFFERENT DREDGES

Type of Dredge	Turbidity		Remarks
1. Cutterhead			
10 RPM	161 mg/liter (sandy clay)	52 mg/liter (med. clay)	Observations in the Corpus Christi Channel
20 RPM	187 mg/liter (sandy clay)	177 mg/l (med. clay)	
30 RPM	580 mg/l ( " " )	266 mg/l ( " " )	
18 RPM	1 mg/l to 4 g/l within 3 m of cutter		Soft mud at Yokkaichi Harbor, Japan
18 RPM	2 mg/l to 31 g/l within 1 m of cutter		
2. Plain Suction Dredge	Little turbidity for free-flowing sand. Significant turbidity at the bottom with water jets.		
3. Dustpan Dredge	Little turbidity for free-flowing sand. Significant turbidity at the bottom created by water jets.		
4. Pneuma Pump	48 mg/l at 1 m above bottom 4 mg/l at 7 m above bottom (5 m in front of pump) 13 mg/l at 1 m above bottom		Port of Chofu, Japan  Kita Kyushu City, Japan
5. Grab/Bucket/Clamshell Dredges	Less than 200 mg/l and average 30 to 90 mg/l at 50 m downstream (background level 40 mg/l)		San Francisco Bay
	168 mg/l near bottom 68 mg/l at surface		100 m downstream at lower Thames River, Connecticut
	150 mg/l to 300 mg/l at 3.5 m depth		Japanese observations
6. Anti-turbidity Watertight Buckets	30 to 70% less turbidity than typical buckets.		Japan
	500 mg/l 10 m downstream from a 4 cu. m. watertight bucket.		

## ACCURACY OF THE DREDGING PROCESS

### Dustpan Dredge

Vertical control: 1 ft

Horizontal control: 3 ft

### Cutterhead Dredge

Vertical accuracy  $\pm 6-9$  in. (protected waters)

Vertical accuracy  $\pm 1$  ft in sand and silty sand

Vertical accuracy  $\pm 1.5$  ft in muck

### Dipper Dredge

Quite accurate  $\pm 3$  in.

### Clamshell Dredge

Vertical accuracy  $\pm 9$  in.

Note: Accuracy depends on the experience of the operator and on the type of soil. Also, on whether dredging is part of the maintenance work or new work.

### SEDIMENT RE-SUSPENSION DURING DREDGING OPERATION

Other losses of sediment during the dredging operation include sediment re-suspension. The cutter of a cutterhead dredge re-suspends sediment thus creating a cloud which may not find its way into the suction pipe and may stay in the water column for a long time if composed of fine sediment. A clamshell impacts on the bottom sediments in order to pick up as much sediment as possible and it is then hoisted through the water column loosing as much as 30 to 50 percent of fine sediment. The watertight clamshell would loose about 35 percent less of sediment as it is hoisted through the water column.

Estimates of PCBs released during dredging operations are given in Table 6. The values of PCBs resuspended are shown in pounds for various locations indicated in Figure 1.

The highest weights of re-suspended PCBs are for the clamshell dredge and the lowest are for the Pneuma dredge.

**TABLE 6. Estimates of PCB's released during dredging operations  
(values given in pounds)**

SUMMARY									
No.      Type of Dredge		Location							
		A		B		C		D	
		At 10 ft	At 100 ft	At 10 ft	At 100 ft	At 10 ft	At 100 ft	At 10 ft	At 100 ft
1	Cutterhead Dredge* cutter speed 10 RPM	2,139	212	70.5	7.0	21.9	2.2	2.6	0.3
2	Cutterhead Dredge cutter speed 20 RPM	2,484	246	82	8.1	25.4	2.6	3.0	0.3
3	Cutterhead Dredge cutter speed 30 RPM	4,575	764	254	25.2	78.9	7.9	9.4	1.1
4	Plain Suction Dredge with water jets			comparable to cutterhead dredge (No. 1-3)					
5	Dustpan Dredge			comparable to cutterhead dredge (No. 1-3)					
6	Grab/Bucket/Clamshell	12,700		420		140		20	
7	Watertight Clamshell	3,810- 8,890		126- 294		42- 98		6- 14	
8	Pneuma Dredge								
	(a) above the bottom	138		4.5		1.5		0.2	
	(b) near the bottom	510		16.5		5.0		0.5	

\*Based on 3 ft cutter and 2.5 cfs turbid flow.

## DREDGING EFFICIENCY

Dredging efficiency depends on the type of dredge employed. The estimated cutterhead dredge efficiency in Slip No. 3 is 85.7% as the cutter will leave furrows in its path. The clamshell dredge (either open or closed bucket) is about 87% efficient. Pneuma dredge will also be about 87% efficient. The clamshell dredge will leave an irregular, cratered bottom and the Pneuma dredge will leave a cratered bottom.

### PCBs left at the bottom of the harbor after dredging

#### 1. Slip No. 3 - location A1-A6 (Figure 1)

Estimated volume of sediment: 7,200 cubic yards, mostly muck (Source: Protocol to dredge, 5/23/1984)

Calculated weight of PCBs: 167,000 lbs

Weight of PCBs left at the bottom after dredging:

a) cutterhead dredge: 23,881 lbs

b) clamshell dredge: 21,710 lbs

#### 2. Near Outfall

Estimated volume of sediment: 3,700 cubic yards, sand clay and fill (Source: Protocol to dredge, 5/23/1984)

Calculated weight of PCBs: 138,000 lbs

Weight of PCBs left at the bottom after dredging:

a) cutterhead dredge: 19,734 lbs

b) clamshell dredge: 17,940 lbs

Note: Pneuma dredge and a watertight clamshell dredge will leave the same amounts of PCBs as the clamshell dredge.

## OTHER LOSSES OF SEDIMENT AND WATER CONTAINING PCBs

In addition to re-suspension of sediment by the dredging process, other losses occur that are caused by leaks at the pump-pipe connections, at the pump seals, at the pipe joints, ball joints, etc. Some water and sediments containing PCBs could be lost along the discharge pipeline, or at the pump located on the dredge. Some contaminated water could escape during decontamination of equipment used such as pipes, pumps, valves, clamshells, etc. Evaporation of water will occur during the dredging process, at the treatment plant, during trucking operations, and from the surface of disposal lagoons.

## CONCLUSIONS

1. Several types of dredges were considered for removal of bottom sediments from Slip No. 3; the most suitable dredging plants include a cutterhead dredge and a Pneuma dredge. A clamshell dredge is recommended in "Conceptual Design" Report EPA 13-5M28.0.
2. Sediment removal efficiency is estimated to be 85.7% for the cutterhead dredge and 87.0% for both Pneuma dredge and the clamshell dredge.
3. Weight of PCBs left in Slip No. 3 after dredging is estimated to be 23,881 lbs for the cutterhead dredge and 21,710 lbs for the clamshell and Pneuma dredge.
4. Weight of PCBs left in an area near the outfall after dredging is estimated to be 19,734 lbs for the cutterhead dredge and 17,940 lbs for the clamshell and Pneuma dredge.
5. The concentration of PCBs will be much greater at the bottom after dredging than it is at present since fine silt has covered the bottom in recent years. The fine sediment deposition, in effect, has capped the contaminated sediment.
6. PCBs will be re-suspended in the water column by the dredging process. It is estimated that at least 2,139 lbs of PCBs will be re-suspended by the cutterhead dredge and about 12,700 lbs of PCBs by the clamshell dredge.
7. Additional sediment losses will occur during the dredging process because of leaks in pumps, pipeline joints, etc.
8. The fine re-suspended sediment will take a long time to settle in Slip No. 3. Calculations based on the sediment samples taken indicate that 63% of solids will settle in about 40 days, and that 77% of solids will settle in about 4160 days. Wind-generated currents will keep the solids suspended for indefinite periods of time.

**B**



## **Golder Associates**

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

REPORT ON

### IN-PLACE CONTAINMENT ALTERNATIVES, OUTBOARD MARINE CORPORATION

Submitted to:

Martin Craig Chester & Sonneschein  
55 West Monroe Street  
Chicago, Illinois 60603

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June 1987

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## **Golder Associates**

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

June 24, 1987

863-3389

Martin, Craig, Chester & Sonnenschein  
55 West Monroe Street  
Chicago, Illinois 60603

Attn: Mr. Jeffrey C. Fort

RE: REPORT OF IN-PLACE CONTAINMENT ALTERNATIVES,  
OUTBOARD MARINE CORPORATION

Gentlemen:

Attached are two copies of our report on the referenced subject. The report provides technical documentation for evaluating the effectiveness of the In-Place Containment (IPC) alternative and a comparison of the in-place containment with an "upland" disposal site specified in the Record of Decision (ROD).

Based on the analysis of the available data, the following conclusions can be drawn:

1. The proposed remedial alternative differs from that specified in the ROD in that the spoil dredged from the Upper Harbor will be contained in Slip No. 3. The consequence of this alternative is that release of PCBs to the environment by volatilization and as a result of the dredging operation will be reduced.
2. The proposed action also differs from the ROD alternative in that it provides for a permanent in-place water withdrawal and treatment system for all containments to actively control, as required, water levels in the containment areas and, hence, create an inward gradient, thereby preventing aqueous movement of PCBs from the containments.
3. The in-place containment in Slip No. 3 satisfies all of the TSCA requirements for a chemical waste landfill, with the exception of the requirement for a 50 foot separation between the liner system and the groundwater table. However, analyses of the possible contaminant transport mechanisms, together with the expected PCB mass loading rates, indicate

that a waiver of this requirement is appropriate. Such a waiver will not present an unreasonable risk of injury to health or the environment from PCBs.

4. The requirement for flood protection is not considered to be directed at closed landfills.
5. Evaluation of the IPC alternative, based on available data, demonstrates that it is technically feasible and effective. Even if site specific data establish that strong vertical gradients exist at the site and that it will be difficult to maintain a uniform inward gradient across the containment, the consequences are minimal enough to be considered insignificant.
6. Additional data are required to design the remedial alternative and to quantitatively address some aspects of the containment effectiveness. These data include:
  - . site specific potentiometric levels;
  - . properties of the various soil strata;
  - . water quality data in the Silurian Aquifer;
  - . background groundwater quality data.

A field exploration program to provide these data has been prepared.

Should you require any further submittals, please call.

Very truly yours,

GOLDER ASSOCIATES



Kenneth P. Akins, Jr., P.E.  
Senior Engineer



Richard S. Williams, P.Eng.  
Principal

KPA/RSW/rcs

Attachment

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Cover Letter

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## 1.0 INTRODUCTION

In September 1986, US EPA and OMC officials met on two occasions to explore a possible resolution to the matter of PCBs in Waukegan Harbor. During those meetings, OMC and the Agency discussed numerous technical and policy issues. The Agency has expressed its willingness to consider an alternative to the 1984 Record of Decision (ROD) control remedy, on the condition that an alternative remedy provides an equivalent level of protection to human health and the environment as that specified in the ROD. The objective of the remedial actions at the OMC facility is to protect human health and the environment by limiting the release of PCBs.

The US EPA (ROD) has considered combinations of removal and containments which were projected to accomplish certain environmental goals, namely:

1. Long term flux to Lake Michigan will approach zero.
2. PCBs in the water column in Waukegan Harbor will be below 0.02 mg/l.
3. Accumulation of PCBs in fish will be less than 5 mg/l.

The purpose of this submittal is to document the acceptability of on-site containment as an alternative disposal method for dredged spoil containing PCBs, under 40 CFR 761.60 (a)(5)(iii). Many of the technical points addressed are applicable to on-site containments not containing dredged spoil. The technical aspects are presented in a format similar to the technical requirements for chemical waste landfills under TSCA permitting requirements(40 CFR 761.75)

The report is arranged to provide a brief description of the proposed facilities (Section 2.0), a technical evaluation of the proposed containments in the context of TSCA requirements (Section 3.0), comparison of the proposed containments and the remedial alternative defined in the ROD (Section 4.0), and conclusions developed from the technical evaluations and comparisons (Section 5.0).

## 2.0 DESCRIPTION OF FACILITIES AND SITE

The OMC site area is located at the north end of Waukegan Harbor in Lake County, Illinois. Waukegan Harbor is a man-made harbor resulting from a combination of fill placement to provide high ground and dredging to develop the harbor itself. PCBs have been discovered in sufficient quantities for the US EPA to consider a variety of remedial actions at the site, including dredging Waukegan Harbor and the construction of on-site containments.

### 2.1 Proposed In-Place Containments

OMC is proposing the development of three containments to minimize the uncontrolled release of PCBs to the environment. The three containments proposed by OMC to limit movement of PCBs at the site have four key common features:

1. Use of the till underlying the site as the bottom of the containment.
2. Construction of a perimeter slurry wall penetrating into the till.
3. Pumping from inside the contained area.
4. Placement of a High Density Polyethylene (HDPE) cover as a part of final closure.

One containment, consisting of a slurry wall extending into glacial till underlying the site, would be constructed around the Crescent Ditch - Oval Lagoon Area. The most heavily contaminated soils from the north ditch would be excavated and moved to this containment. The containment would be closed with a composite HDPE membrane, a compacted clay layer, and a vegetative layer.

A second containment would be similarly constructed around the parking lot area. An option being considered would provide for some dredged spoil to be placed in this containment prior to final closure.

A third containment is proposed in the Slip No. 3 area. Affected portions of Larsen Marine would be relocated around a new slip, to be built east of the existing Slip No. 3. A cofferdam would then be constructed across the upper end of the Upper Harbor near the mouth of Slip No. 3 and a slurry wall would be constructed around the perimeter of the slip, extending into the intact portion of the till. Upper Waukegan Harbor would be dredged and spoil placed in Slip No. 3. Wick drains would be installed to accelerate consolidation and a final closure cover will be installed, consisting of a composite HDPE/clay cover with a vegetative layer. Storage volume requirements will be satisfied by moving the cofferdam and/or storage of some portion of the dredged spoil in the parking lot containment.

The proposed remedial action concept, in-place containment (IPC), is similar to US EPA's initial March 1984 ROD proposal (CH<sub>2</sub>M Hill, 1984b) in that PCB contaminated dredged sediments will be contained within the existing Slip No. 3, and the contaminated North Ditch and parking lot sediments and soils will be contained within containment cells located north of the OMC Plant #2 manufacturing facility. However, it includes additional measures to:

1. Provide property and a new slip for the Larsen Marine operations.

2. Provide a permanent in-place water withdrawal and treatment system to actively control, as required, the water levels within the containment areas, and hence create an inward gradient, thereby preventing aqueous movement of PCBs from these areas.
3. Provide an HDPE cover for all in-place containment areas.

## 2.2 Hydrogeologic Setting

The hydrogeologic regime has been characterized from documents provided to Golder Associates and numerous references collected by Golder Associates.

The generalized strata at the site, in order of increasing depth, are as follows:

1. Fill placed to form the high ground surrounding the Harbor.
2. Beach sands and near-shore sands (Ravinia Formation).
3. A silty glacial till (Wadsworth Till).
4. Dolomites of Silurian Age (Niagaran and Alexandrian).
5. Shale of Ordovician Age (Maquoketa).

The lower portions of the Ravinia sands are saturated and apparently hydraulically connected to Lake Michigan. The Silurian dolomites are referred to as the Silurian Aquifer.

### 2.2.1 General Conditions

The site is located in an area of lacustrine deposits, although much of the surficial soil is "made land" (fill materials). The underlying sand deposits are part of the Ravinia member of the Lake Michigan Formation, primarily

consisting of beach sands along the shore of the lake, approximately 25 feet thick. On-shore and off-shore facies have been identified, indicating continuity under the lake (Larsen, 1973; JRB Associates, 1981). The bottom of these deposits is typically in the range of elevation 550 ft. to 560 ft. MSL.

The Wadsworth Till member of the Wedron Formation underlies the sands in most of Lake County. The till is generally characterized by a yellow or olive brown color in the oxidized zone and gray below the oxidized zone. Published data suggest that the formation is a silt till, locally sandy or clayey, with a total thickness in the range of 50 ft. to 100 ft. (Larsen, 1973). This is supported by data from the Zion Nuclear Station North of Waukegan (Commonwealth Edison, 1965) which indicate a till thickness of approximately 70 feet.

The sample descriptions on test boring records at the OMC site confirm the nature of the till. However, "gray" is the predominant color descriptor noted in borings put down at the site and, thus, the oxidized zone may be thin or absent at the site. Atterberg limit tests performed on samples of till (Warzyn, 1979 and 1980) yielded liquid limits in the range of 17 percent to 29 percent, with plasticity indices in the range of 1 percent to 12 percent.

Underlying the till are dolomite rocks of Silurian Age which are reported to be 200 feet to 300 feet thick in the vicinity of the site (Hughes et. al., 1966; Larsen, 1973).

### 2.2.2 Hydrogeologic Conditions

The "aquifer" sampled for groundwater quality at the site is the saturated zone in the beach deposits of the Ravinia member, although there was no indication in the literature that the sands were used as an groundwater source in the site area. Gradients and flow direction in this aquifer are influenced by lake levels (JRB Associates, 1981), with flow being nearly horizontal. Some near-vertical flow near ditches has been inferred (JRB Associates, 1981). Horizontal gradients on the order of 0.0025 ft./ft. to 0.0005 ft./ft. can be interpreted from the available data.

The Wadsworth Till separates the water saturated Ravinia beach deposits from the underlying Silurian Dolomite Aquifer. Offshore data indicate that the till is continuous well out beneath Lake Michigan (Lineback, et. al., 1974). Site specific data on permeability of the till was not found in documents provided to Golder Associates; however, other literature (Prickett, et. al., 1964) suggests permeabilities on the order of  $1 \times 10^{-7}$  cm/sec to  $5 \times 10^{-7}$  cm/sec, based on large-area water balance analyses. The piezometric level at the surface of the till is likely to be hydrostatic.

The Silurian aquifer beneath the Wadsworth Till is a confined aquifer, with the till above and the Maquekota Shale below acting as aquitards. Review of the published literature suggests the Silurian Aquifer in the Waukegan Area is only used on a very limited basis because of a high hydrogen sulfide content and the fact that better yields are provided by deeper aquifers (Larsen, 1973). Recharge to the aquifer is interpreted to be through the till (Prickett, et. al. 1964).

Studies of potentiometric levels in the Silurian Aquifer reported in the literature (Prickett, et. al., 1964; Hughes, et. al., 1971; Woller and Gibb, 1976) indicate a potentiometric surface in the vicinity of elevation 600 ft. west of Waukegan, with flow to the east. These data suggest that the pressure heads in the aquifer would be hydrostatic, or even artesian with respect to lake level, based on regional trends. Lake Michigan is considered to be the principal discharge area relative to underlying aquifers. The reported data do not extend into Waukegan, however, and the closest water level data for the Silurian Aquifer is in excess of a mile from OMC site.

Where sufficient data exist elsewhere for valid comparisons, the potentiometric level in the Silurian Aquifer is above the till-aquifer boundary, but below the potentiometric level of the saturated surficial deposits. Measured vertical gradients through the till at sites within 25 miles to 30 miles of the site are downward in the range of 0.8 to 1.1 (Hughes, et. al., 1969). Thus, a vertical downward hydraulic gradient could exist at the site, in apparent contrast to the near hydrostatic conditions expected in the vicinity of the site (Prickett, et. al., 1964). This condition is consistent with the interpretation in the literature that recharge for the Silurian Aquifer is through the confining till.

On the basis of the available information, the following inferences have been made.

1. The potentiometric head in the Silurian Aquifer decreases from west to east.
2. Potentiometric levels at isolated wells within a 15 mile radius of the site area and for which data are available indicate declines in potentiometric heads in the aquifer on the order of 3 feet to 20 feet in twenty to thirty

years. Published reports generally indicate a potentiometric decline on the order of one foot per year in those areas where the aquifer is used (Prickett, et. al., 1964).

3. Data from isolated sources (Hughes, et. al., 1971; Woller and Gibb, 1976) indicate potentiometric levels below elevation 570 ft. MSL, both south and north of Waukegan, in contrast to the potentiometric elevation of about 600 ft. suggested by Prickett, et. al. (1964).

In summary, regional flow through the till is described in the literature as near-vertical, with hydraulic gradients on the order of 0.5 to 1.0 at some sites studied. The gradients are consistent with large head losses in low-permeability zones. However, as previously noted, other data (Prickett, et. al., 1964) indicate that the general flow regime is such that a hydrostatic condition would exist at the OMC site and the potentiometric levels in the aquifer could even be artesian with respect to the lake level (i.e., higher than the lake level). In consequence, therefore, no definite conclusions can be drawn in relation to the site-specific flow regime, although the available data in reasonable proximity to the site suggest near hydrostatic potentiometric levels in the Silurian Aquifer. The consequences of local conditions being markedly different from this expectation are discussed in the following sections.

### 3.0 TECHNICAL EVALUATION OF CONTAINMENTS

The rationale for seeking approval for an alternate disposal method for the dredged spoil is vested in the fact that this alternative will provide adequate protection to health and the environment. However, the alternative method also satisfies all of the requirements for a TSCA approved chemical waste landfill, other than the requirement that the bottom of the landfill be 50 feet above the historical high groundwater table. A waiver of this requirement can be justified on the basis that the alternative containment system will not present an unreasonable risk of injury to health or the environment and, based on our analyses, no greater risk than the alternative specified in the Record of Decision.

To this end therefore, it is appropriate to evaluate the expected technical performance of the containment systems in relation to the requirements for a chemical waste landfill under TSCA (40 CFR 761.75).

#### 3.1 TSCA Requirements

Chemical waste landfills approved for the disposal of PCBs are required to satisfy the following technical criteria (40 CFR 761.75 (b)):

1. Be located in relatively impermeable formations or in soils with a thickness of 4 feet, and which exhibit the following physical characteristics:
  - . permeability  $<1 \times 10^{-7}$  cm/sec
  - . 30 percent finer than 0.074 mm.
  - . liquid limit >30 percent
  - . plasticity index >15 percent.

- 
2. A synthetic liner is required if the above criteria cannot be satisfied.
  3. The bottom of the landfill should be 50 feet above the historic high groundwater table.
  4. Be protected from inundation from the 100 year flood.
  5. Be located in low to moderate topography.
  6. Be equipped with surface water and groundwater monitoring systems.
  7. Have a leachate collection monitoring system.
  8. Have an operations plan.
  9. Adequate supporting facilities (fence, roads, etc.) must be provided.

It must be recognized that these technical requirements apply to an operating chemical waste landfill and, as such, some of them are more germane to operating conditions than to closed conditions (e.g. the need for flood protection). Thus, the strict applicability of these criteria to the proposed containments at the OMC site should be evaluated in this light.

### 3.2 Anticipated Containment Performance

The purpose of containment structures is to minimize the movements of contaminants both vertically and horizontally. For the proposed containments at OMC, vertical movement of contaminants is to be controlled by the till, while horizontal movement is to be controlled by the slurry walls and till. The effectiveness of these two control measures, in relation to the technical requirements of TSCA identified above, are discussed in the following sections.

### 3.2.1 Soil Characteristics

The available data indicate that the till at the site is continuous well into Lake Michigan, with an average thickness on the order of 70 feet and permeabilities in the range of  $5 \times 10^{-7}$  cm/sec. to  $1 \times 10^{-7}$  cm/sec. Thus, the ratio of thickness to permeability (D/K) at the site is expected to be in the order of  $14 \times 10^7$  to  $70 \times 10^7$ . This is well in excess (3 to 20 times) of the D/K ratio of  $4 \times 10^7$  required by the TSCA regulations, with the net result being that travel times through the till will be at least three times the minimum required by TSCA, assuming a given hydraulic gradient. Consequently, even though the available soil plasticity data do not satisfy the TSCA criteria (liquid limit of at least 30 and plasticity index in excess of 15), the overall requirement that the site be located in a thick, relatively impermeable formation is completely satisfied, and a liner (synthetic membrane or compacted soil) is not warranted.

While the till will act as a low permeability barrier across the bottom of the containment structures, the permeability of the overlying sands is expected to be much greater. Published data, together with site specific measurements in the north ditch area, strongly indicate that PCB compounds are relatively immobile even in relatively highly permeable strata. However, slurry walls keyed into the intact till are proposed for all containments to limit any potential lateral migration of contaminants. Slurry walls have been proven to effectively contain groundwater contaminants because of the low permeabilities which can be obtained with careful construction techniques (typically in the range of  $10^{-7}$  cm/sec. to  $10^{-10}$  cm/sec.). The width of the slurry walls will be selected to provide the desired containment effectiveness.

### 3.2.2 PCB Migration Through Containment Structures and Demonstration of Containment Effectiveness

Although the proposed containment sites satisfy the TSCA requirements for the geological setting for a chemical waste landfill, the structures will be below the groundwater table. Thus, the potential effects of this need to be evaluated in terms of whether these effects will violate the spirit of the TSCA requirement for a 50 foot separation between the landfill liner and the groundwater table.

The intent of the required separation is to minimize any potential groundwater contamination from contaminant flow through the sides and the bottom of the facility. To this end, the required 50 foot separation is intended to provide an unsaturated zone through which contaminant mobility will be limited.

However, evaluation of contaminant transport studies done to date at the OMC site strongly indicates that the expected release of PCBs to the environment can be considered negligible. The studies (CH<sub>2</sub>M Hill, 1983) estimate that releases for the various containments would be as follows:

<u>Structure</u>	<u>Release Rates (lbs/year)</u>	
	<u>Side Walls</u>	<u>Bottom</u>
Crescent Ditch - Oval Lagoon	0.001	0.001
Parking Lot	0.002	0.02
Slip No. 3	0.0006	0.003

The estimates for Slip No. 3 by CH<sub>2</sub>M Hill assumed no "hot spot" removal. As well, these estimates are based on the use of a clay cover over the containment cells, and more importantly, do not include pumping from inside the containments.

Assuming the general validity of the CH<sub>2</sub>M Hill estimates, it is clear that such mass loading rates will result in very small PCB concentrations in the aqueous phase, particularly if dispersion and dilution mechanisms are taken into account.

The aqueous migration of contaminants is mitigated even further by the fact that the containment covers being presently proposed will consist of a composite clay/HDPE system and the fact that pumping from within the containments is also proposed to create an inward gradient. These provisions will result in a reversal of the hydraulic gradients and, therefore, will theoretically eliminate aqueous phase contaminant migration to the groundwater regime in response to these gradients.

It is noted, however, that the ability to create inward gradients at all points in the containment by internal pumping is functionally dependent on the existing vertical hydraulic gradients at the site. As previously identified, the available data suggest that the potentiometric levels in the Silurian Aquifer are close to hydrostatic with respect to the lake level. For this condition, analyses show that internal pumping will result in an inward gradient across the containment structures. However, in the event that significant vertical gradients exist at the site, internal pumping rates can be increased to maintain inward gradients and the planform dimensions of the cells can be restricted to some extent.

In the final analysis, however, even if a uniform inward gradient cannot be maintained across the entire containment cell, the consequences in terms of aqueous contaminant

migration are not significant, in view of the very small mass loading rates. Therefore, aqueous phase contaminant migration from the IPC in response to hydraulic gradients will be, at worst, similar to that from the ROD alternative and, at best, well theoretically be non-existent.

The preceding analyses relate to PCB transport in the aqueous phase. In light of the very low solubility of PCB compounds generally, and particularly in view of the fact that the principal compound identified at the site is Arochlor 1248, which is at the lower end of the solubility scale, dense non-aqueous phase liquid (DNAPL) movement must be evaluated.

Published case history data (Schwartz, et. al., 1982) demonstrated that DNAPL movement of PCBs from a spill was controlled by the presence (or absence) of fractures in the soil. The controlling mechanism is attributed to the high surface tension forces associated with the movement of immiscible fluids through small pore spaces. Without a well developed secondary porosity pattern, very high pressures are required to overcome these tension forces, together with the forces associated with flow path tortuosity and the chemical affinity of PCBs for solids.

These data are very consistent with site specific information previously reported (Mason and Hanger, 1982). Actual measurements of PCB concentrations in the upper 5 feet of till demonstrated a dramatic attenuation in the concentration levels over a short distance. In the area of Slip No. 3, concentrations decreased from as high as 133,698 ppm at the till surface to 3.4 ppm at a depth of 5 feet below the surface. The observed alternation may well be within the

oxidized zone of the fill, where secondary porosity is to be expected. Thus, alteration would be expected to be even higher on the intact portions of the fill. Even more pronounced attenuation was reported in the area of the North Ditch.

Based on these data, therefore, it is apparent that any potential releases from Slip No. 3 will be negligible, and a waiver of the requirement under TSCA for a 50 feet separation between the landfill and the water table appears to be appropriate from the point of view of its not presenting an unreasonable risk of injury to health and the environment.

### 3.3 Flood Protection

The requirement for flood protection at a disposal site reduces the possibility of surface water removing contaminants from the disposal area, or flooding the active area and increasing contaminant transport out of the area by hydrodynamic transport. In our opinion, the greatest threat by flooding is posed when a site is still open. For a properly closed site, the flood protection requirement is not relevant in our opinion.

The 100 year flood level at the OMC plant is reported to be at elevation 584 MSL. However, even if the containment areas were inundated, it must be recognized that the containments at the OMC site will be closed with a low permeability synthetic membrane which will be designed to withstand ponded water. In consequence, the flood waters will not have access to the contaminated sediments and surface water contamination will not result. Thus, the TSCA requirement for flood protection is not considered to be relevant to closed sites such as the OMC site.

### 3.4 Topography

The intent of considering the topography of a disposal/containment area is to reduce the risk of hazards such as erosion, landslides or slumping which could disrupt the containment and allow the release of contaminants.

The topography of the site is nearly flat and is subject to very little erosion from precipitation runoff. Of the three containments proposed, the parking lot is the closest to the open water of Lake Michigan and, therefore, faces the greatest threat from beach erosion which has been observed both north and south of Waukegan. However, the immediate vicinity of the site is in a depositional area of "beach building" (CH<sub>2</sub>M Hill, 1983). Therefore, beach erosion is not considered to be a problem at this site.

The Slip No. 3 containment will be adjacent to the sheltered water of limited extent in Waukegan Harbor. A study of potential wave effects (CH<sub>2</sub>M Hill, 1984a) has indicated that wave action will not cause problems in the harbor if Slip No. 3 is closed.

### 3.5 Monitoring System

The intent of the required groundwater monitoring system is to detect any unplanned releases of contaminants from the containments. Proper monitoring system design includes consideration of containment geometry, hydrologic conditions, and development of reliable baseline data. This last item is particularly important since the most appropriate measure of the containment efficiency will be departures from background or baseline levels.

The actual configuration of the monitoring system are properly a design function and will be confirmed as the design and evaluation of containments is completed. However, groundwater quality monitoring wells at regular intervals around the perimeter of each containment will most likely be installed and it is likely that wells will be installed in the till to provide early identification of contaminant releases. Specific parameters to be used as indicators will include pH, specific conductance and PCBs (differentiated by chlorine content).

### 3.6 Leachate Control

Leachate control within the containments will be accomplished by minimizing leachate generation through use of a composite clay/HDPE cover, as well as by pumping from within the containments. Pumping from within the containments will perform the following functions:

1. Remove infiltrating precipitation before final closure.
2. Remove incidental infiltration of precipitation after the cover is in place.
3. Remove excess liquids which may drain out of contained materials, especially in the case of containment of dredged spoil.
4. Create inward gradients.

Thus, pumping will act in a manner similar to a conventional leachate control system, in that it will create an inward horizontal gradient from the surficial soils, through the slurry wall, into the containment. As noted, the design for creating an inward gradient will depend, in part, on site-specific potentiometric levels which will be identified in field explorations for the design phase.

The effectiveness of the internal pumping system will be enhanced by selective deposition of the dredged spoil. Sequential placement of layers of bottom muck and Ravinia sand will allow for the creation of drainage layers within the spoil from which pumping can be effected.

The collected leachate will be monitored routinely for PCBs, treated as necessary, then released.

### 3.7 Operations

The US EPA has determined that removal of PCBs in concentrations greater than 50 ppm from the open harbor is necessary, and dredging is the appropriate method. Controlling suspended solids in the harbor is common to all dredging schemes (CH<sub>2</sub>M Hill, 1983). Approximately 46,600 cubic yards of material containing 310,200 pounds of PCBs with concentrations in excess of 50 ppm in the Slip No. 3 and the Harbor must be addressed. With a Slip No. 3 containment, 5700 cubic yards of material containing 286,500 pounds of PCBs could be left in place and not disturbed by dredging.

Materials which are dredged into slip No. 3 will not be moved again. A non-flowing consistency will be achieved in place by surcharging and, if necessary, accelerating settlements with the use of wick drains. Pilot studies have demonstrated the technical feasibility of wick drains for this type of application (Spotts and Townsend, 1977).

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Using these salient points, an operations plan will be developed during the Remedial Design which will detail how dredged spoil will be placed and how the measures specified in TSCA will be addressed. The plan will include specific methodologies for the operation of the various elements of the IPC such as:

- . filling sequences;
- . timing and use of interim and final closures;
- . operation of the internal pumping system during both the filling stage, as well as the post-closure period;
- . leachate management and disposal procedures and criteria; and
- . post-closure inspection and maintenance procedures.

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#### 4.0 COMPARISON OF PROPOSED CONTAINMENTS WITH ROD

The In-Place Containment (IPC) proposed provides for replacement of marina facilities presently at the north end of the Upper Harbor and Slip No. 3, followed by construction of a permanent containment in what is now Slip No. 3 and the north portion of the Upper Harbor for disposal of dredged spoil. The IPC also provides for internal water removal systems, as discussed previously. Other details of the proposed IPC alternative are the same as those identified in the ROD.

There are three common aspects of the IPC and ROD Remedial Alternative (RA) which are important to the technical evaluation of containment effectiveness:

1. The bottoms of both the IPC and the RA containments would be the till which underlies the site.
2. The sides of both the IPC and RA containment would be slurry walls extending into the till.
3. Both the IPC and the RA containments extend below the surficial groundwater level.

Because of the similarities of the IPC and RA containments and the provision for development of inward gradients, the projected mass loading rates for PCBs from the containments are expected to be less for the IPC alternative. As well, the HDPE cover planned for the IPC alternative will reduce infiltration below that expected for the clay cap of the RA and as a result, control of the hydraulic gradients within the containment cells will be facilitated by the IPC.

The IPC solution proposed by OMC offers several advantages over that defined in the ROD:

1. The pumping from inside the containments in the IPC would reduce the mass loading rate of PCBs to the groundwater regime.
2. The time of implementation is less. Under the IPC alternative, the parking lot area is not intended to be the primary storage area for dredged spoil and, as such, can be closed sooner than under the ROD alternative.
3. The need to construct interim surface impoundments is avoided; the IPC moves material only once and hence, results in less PCBs released from handling and volatilization.
4. Uncertainties associated with drying time or fixation requirements for dredged spoil to allow movement from interim surface impoundments to final containments are avoided. In our opinion, the sedimentation rates for dredged spoil, the stabilization techniques and drying time estimates provided in the ROD Feasibility Study are optimistic and may well be substantially longer.
5. The "upland" containment required by the ROD would be subject to greater erosion potential because of its location, mounded configuration and proximity to the open waters of Lake Michigan.
6. The HDPE cover will reduce infiltration into the containment compared to that expected from a clay cover alone. Practical benefits to be realized would be reduced pumping requirements to maintain control of inward gradients.
7. The dredged spoil containment specified in the ROD would be physically more accessible than the IPC, with greater potential for unauthorized access and contaminant release.

Thus, in summary, the IPC alternative offers several several technical advantages over the ROD alternatives in terms of construction staging, engineering performance and long term security from both environmental damage and unauthorized access.

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## 5.0 CONCLUSIONS

Based on the preceding analysis of the available data, the following conclusions can be drawn:

1. The proposed remedial alternative only differs from that specified in the ROD in that the spoil dredged from the Upper Harbor will be contained in Slip No. 3. The consequence of this alternative is that release of PCBs to the environment by volatilization and as a result of the dredging operation will be reduced.
2. The proposed action also differs from the ROD alternative in that it provides for a permanent in-place water withdrawal and treatment system for all containments to actively control, as required, water levels in the containment areas and, hence, create an inward gradient, thereby preventing aqueous movement of PCBs from the containments.
3. The in-place containment in Slip No. 3 satisfies all of the TSCA requirements for a chemical waste landfill, with the exception of the requirement for a 50 foot separation between the liner system and the groundwater table. However, analyses of the possible contaminant transport mechanisms, together with the expected PCB mass loading rates, indicate that a waiver of this requirement is appropriate. Such a waiver will not present an unreasonable risk of injury to health or the environment from PCBs.

The requirement for flood protection is not considered to be directed at closed landfills.

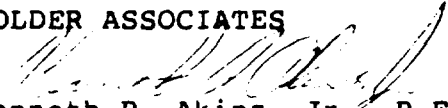
4. Evaluation of the alternative, based on available data, demonstrates that it is technically feasible and effective. Even if site specific data establish that strong vertical gradients exist at the site and that it will be difficult to maintain a uniform inward gradient across the containment, the consequences are minimal enough to be considered insignificant.
5. Additional data are required to design the remedial alternative and to quantitatively address some aspects of the containment effectiveness. These data include.

. site specific potentiometric levels;

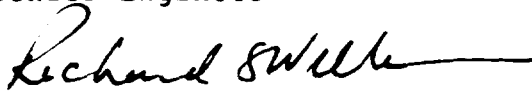
- . properties of the various soil strata;
- . water quality data in the Silurian Aquifer; and
- . background groundwater quality data.

A field exploration program to provide these data has been prepared.

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DEPARTMENT OF THE ARMY  
CHICAGO DISTRICT, CORPS OF ENGINEERS  
212 SOUTH DEARBORN STREET  
CHICAGO, ILLINOIS 60604

21 MAY 1984

REPLY TO  
ATTENTION OF:

Planning Formulation Section

Mr. Hugh Thomas  
Secretary & Assoc. General Counsel  
Outboard Marine Corporation  
100 Sea Horse Drive  
Waukegan, Illinois

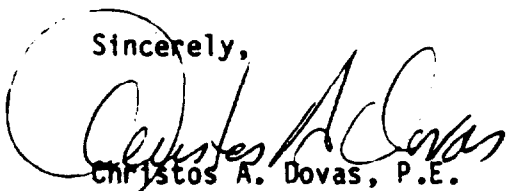
Dear Mr. Thomas:

Enclosed for your information and review is one (1) copy of the Site Selection Study for the Waukegan Harbor Confined Dredge Disposal Facility. It was prepared by the Chicago District, Corps of Engineers under the authority of Public Law 91-611, Section 123 which authorizes the Secretary of the Army to construct contained spoil disposal facilities. A separate study for cleanup of the harbor was undertaken by the United States Environmental Protection Agency (USEPA) under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (Superfund). Please note that the study by the Corps of Engineers deals with dredge material from some areas of the harbor which would not be dredged under the USEPA proposal.

At this time no recommendation is made as to which site should be used for disposal of the dredgings from Waukegan Harbor. This study is intended as an aid to coordination between the various agencies which will participate in the selection of a site. A public workshop will be organized and announced by the Corps of Engineers for the month of June. Which of the sites ultimately is recommended will be based on consideration of construction and operation costs, environmental impacts, and the desires and concerns of a local sponsor, local and Federal agencies and the general public.

If you wish to make any comments on the study, please respond by 29 June 1984. Should you require additional information or have any questions, please contact Mr. Steve Spicer of our Planning Branch 312/353-6510.

Sincerely,

  
Christos A. Dovas, P.E.  
LTC, Corps of Engineers  
District Engineer

Enclosure

APR 1984

Waukegan, Illinois  
Continued from page 13

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL AREA  
SITE SELECTION STUDY

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WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL AREA  
SITE SELECTION STUDY

Waukegan Harbor, Illinois  
Confined Dredge Disposal Facility  
Site Selection Study

1. PURPOSE OF REPORT. This report presents the results of engineering, operational and environmental analysis of various sites proposed to be used for the disposal of polluted maintenance dredging from Waukegan Harbor. The report will serve as the basis for recommending a plan for containing the dredgings determined to be unsuitable for open lake disposal.

2. PROJECT LOCATION. As shown on Plate 1, Waukegan Harbor is located in northeastern Illinois (Lake County) on the west shore of Lake Michigan, about 35 miles north of Chicago and 16 miles south of Kenosha, Wisconsin.

3. Existing Project.

a. Authorization. The existing Federal Navigation Project at Waukegan Harbor was authorized by the River and Harbor Act of 14 June 1880 and subsequent acts as indicated on Table No. 1

b. Description. The existing project, as shown on Plate 2, provides for the following:

(1) A northerly exterior timber crib breakwater 600 feet long and a concrete and steel pile extension to shore about 1300 feet long.

(2) Two parallel timber crib and pile piers about 240 feet apart, 2074 and 3111 feet long for north and south piers respectively, the inshore end of the south pier diverging southward opposite river basin. The north pier length includes the north revetment.

(3) An entrance channel 390 feet wide and 22 feet deep from that depth in the lake to the east end of the north pier, reducing to a channel 200 feet wide between piers and 18 feet deep.

(4) An inner basin 18 feet deep, 375-500 feet wide, and 1,650 feet long.

(5) A revetment 882 feet long at the southwest corner of the inner basin.

All depths are referred to low water datum (International Great Lakes Datum elevation 576.8 feet above mean water level at Father Point, Quebec) for Lake Michigan.

c. Status. The existing project is complete. As indicated in Table No. 1, certain portions of the project have been deauthorized.

Table No. 1  
Authorizing Legislation

Acts	Work Authorized	Documents
June 14, 1880	Parallel piers and basins.	Annual Report, 1880, p. 1942.
Aug. 3, 1882	Modified location of harbor entrance.	Annual Report, 1882, pp. 277, 2162.
June 13, 1902	Detached breakwater, extend piers, increase width of harbor at inner end of north pier, and dredge channel and basin to depth of 20 feet.	H. Doc. 343, 56th Cong., 1st sess.
July 3, 1930	Extension of breakwater to shore, dredging near outer end of north pier, and enlarging inner basin.	Rivers and Harbors Committee Doc. 27, 71st Cong., 2d sess.
Mar. 2, 1945	Dredge an entrance channel to existing project dimensions from outer end of north pier to project depth in lake, and dredge an anchorage area in southwest corner of inner basin to existing project depth. Abandonment of dredging triangular area in southwest corner of inner basin to 18 feet deep.	H. Doc. 116, 77th Cong., 1st sess.
Dec. 17, 1970 Sec. 201	Provides for deepening the existing entrance channel in the outer harbor to 25 feet and extending it to that depth in Lake Michigan, at widths varying from 380 feet to 500 feet; deepening the channel between piers to a depth of 23 feet at a width of 180 feet, and deepening the inner basin to 23 feet and extending its limits approximately 275 feet northward.	H. Doc. 368, 90th Cong., 2d sess.
Oct. 27, 1965 (1)		

(1) Project deauthorized in 1983.

d. Local Cooperation. The required local cooperation is indicated in the various River and Harbor Acts listed in Table No. 1. However, none of these acts require that dredge disposal areas for maintenance dredging be furnished as an item of local cooperation.

e. Maintenance Requirements. The estimated dredging backlog, based upon 1982 examination soundings, is approximately 105,000 cubic yards of material in those areas where deep draft navigation occurs. This volume includes 45,000 cubic yards of sandy sediment in the outer channel which will not require confined disposal.

#### 4. HARBOR NAVIGATION.

a. Waterborne Commerce. The major portion of waterborne commerce in Waukegan Harbor is shipping of building cement and gypsum received by Gold Bond Building Products and Huron Cement Company which are both divisions of National Gypsum Company. In 1982, 114,000 tons of building cement were received and in 1981, 130,000 tons of building cement and 81,000 tons of gypsum were received. A commercial fishing fleet of eight active boats also operates out of the harbor. Thirty-six tons of fresh fish were unloaded at the harbor in 1982 and twenty-five tons were unloaded in 1981. The Port of Waukegan is also homesite to a number of small and large scale industries, including OMC Johnson and Outboard Marine Corporation, together employing over 2,000 persons. Other industries include Falcon Marine and a marine contractor.

b. Recreational Boating. Another key use of the Port of Waukegan is recreational boating. Currently, the Waukegan Port District operates 158 slips and moorings as well as 103 dry dock spaces. Directly to the north of Slip 3, Larson Marine Service houses approximately 300 small pleasure craft for storage and repair. Since the mid 70's the Waukegan area has been recognized as one of the major co-ho and salmon fishing areas on Lake Michigan. The recreational use of the Waukegan Harbor has grown significantly over the past twenty years and has served as the stimulus for the construction of new harbor facilities to the south of Waukegan Harbor which are expected to be completed in 1985. The new facilities will include 761 new slips for small pleasure craft. This expansion will also increase the number of charter fishing boats from 35 in 1983 to a projected 60 charter boats operating out of the Waukegan area in 1987.

#### 5. CONTAINED DISPOSAL OF POLLUTED DREDGE MATERIALS.

a. Authorization. Section 123 of the River and Harbor Act of 1970 (PL 91-611) authorizes the construction of confined dredge disposal facilities to hold maintenance dredgings which are produced over a period not to exceed 10 years. Only dredgings classified as unsuitable for open lake disposal by the Administrator, U.S. Environmental Protection Agency, (USEPA), can be placed within the confinement area. Under this program the cost of construction and maintenance is primarily borne by the Federal Government with local interests required to provide rights-of-way and cer-

tain assurances. The local assurance requirements are given in Paragraph 9. The design capacity is based on an estimate of the total amount of polluted material which will be dredged in a particular harbor over a period of ten years. A copy of Section 123 of PL 91-611 is attached as Appendix A.

b. Dredged Material and Disposal. At the time PL 91-611 was passed the technical base on dredged material and the environmental effects of dredging and disposal was limited. Congress authorized the Dredged Material Research Program (DMRP) also under PL 91-611. The Corps undertook this program via the Waterways Experiment Station (WES) at Vicksburg, Mississippi. Initiated in 1973, the DMRP was accomplished in the planned 5-year time frame at a cost of \$32.8 million. The DMRP was a highly interdisciplinary research effort involving more than 250 individual studies. These consisted of a planned and phased mixture of conceptual, laboratory, and field studies in association with routine Corps projects designed to understand the processes and mechanisms involved in environmental impacts.

The DMRP was designated to be as broadly applicable as possible on a national basis with no major type of dredging activity or region or environmental setting excluded. It thus resulted in methods of evaluating the physical, chemical, and biological impacts of a variety of disposal alternatives-in water, on land or in wetland areas-and produced tested, viable, cost-effective methods and guidelines for reducing the impacts of conventional disposal alternatives. At the same time, it demonstrated the viability and limits of feasibility of new disposal alternatives, including the productive use of dredged material as a natural resource.

Since the completion of the DMRP in 1978, the Corps has continued to develop the technical base of research on dredging and dredged material disposal through support by WES to District offices, exchange of dredging technologies with Japan and the Netherlands, field verification studies done in coordination with the USEPA and studies on the long-term effects of dredged material disposal.

Among the basic conclusions of the DMRP were the following:

- a) No single disposal alternative is suitable for all regions or projects.
- b) Environmental considerations require long-range regional planning as a lasting, effective solution to disposal problems.
- c) As long as the geochemical environment is not changed, most contaminants are not released from sediment particles to the water.
- d) The short-term impacts of increased turbidity from dredging or open-water disposal are primarily aesthetic rather than biological.

e) If a confined disposal site is to be effective from an environmental protection standpoint, it must be efficient in retaining a high percentage of the fine sediments, for it is the clays and silts which carry the contaminants.

Work units of the DMRP have examined the PCB-sediment matrix in laboratory and field investigations. These studies found PCB's to be strongly bound to the fine grained sediment particles, that the release of PCB's from sediments to the soluble portion of the water column was generally not significant, and that the presence of PCB's in the water column was dependent on the presence of suspended solids. Polluted sediments at the bottom of a harbor or river are directly exposed to the water column, and may be resuspended by currents or by navigation traffic. The containment of solids is the key to the disposal of dredged materials. Studies of dredged material disposal areas supported these findings. The removal of PCBs closely matched the solids removal efficiencies. Filtering tests conducted with PCB contaminated sediments from the Chicago District (Indiana Harbor and the Chicago River) have supported these relationships. Recently, leaching tests using PCB contaminated sediments from Ashtabula River, Ohio were conducted. Columns filled with sediments were leached with artificial acid rain for a period of three months. No detectable PCBs were found in the column leachate.

The Diked Disposal Program includes a total of 48 federal navigation projects on the Great Lakes. Twenty-four confined dredged disposal sites have been constructed and two others are under construction. The Chicago District has designed and constructed facilities at Milwaukee, Kenosha, Manitowoc, Kewanee, Green Bay, Michigan City and Lucas Berg, Worth, Illinois. The facility at Calumet Harbor is under construction and will be completed this year.

c. Character of Dredged Materials. The bottom sediments of the Waukegan Harbor have been sampled and analysed by the USEPA (1973, 1976, 1977) and the Corps of Engineers (1981, 1982). Sediments were classified using the USEPA "Guidelines for Pollutational Classification of Bottom Sediments from Great Lakes Harbors" (1977). Most of the sediments within Waukegan Harbor west of the South Pier light are polluted and require confined disposal. However, sandy sediments along the eastern portion of the North Pier are unpolluted and can be disposed in the lake or used for beach nourishment. Survey results have shown a wide spectrum of polluttional levels, with polychlorinated biphenyls (PCBs) being the contaminant of major concern. Results of the analysis of site water indicate little evidence of pollution. Most of the contaminants appear to be contained in the sediments. A summary of the physical and chemical characteristics of the bottom sediments is contained in Appendix B.

## 6. PREVIOUS DREDGING AND DISPOSAL METHODS.

a. Method of Dredging and Disposal prior to 1970. Through 1969, dredging was accomplished primarily with a Government-owned hopper dredge. A Government-owned dipper dredge was used occasionally to cleanup areas not readily accessible to the hopper dredge. The materials were placed in the hopper dredge's bins or scows and bottom dumped in the established deep-water disposal area in Lake Michigan located about 2½ miles east of the north breakwater light.

b. Method of Dredging and Disposal since 1969. Since the discovery of PCB contamination at Waukegan, the only maintenance dredging permitted has been to the east of the south pier light. This work was performed in 1974, 1976, 1977 and again in 1982. No dredging work west of the south pier light, in the navigation channel and inner basin, has been proposed by the Chicago District pending recommendations from USEPA. The USEPA and Corps of Engineers (COE) have done extensive sampling of the harbor area and have determined that the material within the Federal channel contains less than 50 ppm PCBs. Even if the PCB material did not exist in the harbor there are other chemical constituents within the harbor material which warrant it being classified as unsuitable for open lake disposal.

## 7. PROPOSED FUTURE DREDGING

a. Area of Dredging. The Corps of Engineers is limited to dredging the authorized Federal channel, as shown on Plate 2, at Waukegan. The US Environmental Protection Agency has recommended that, following dredging operations, the level of PCB at the exposed surface of sediment not exceed the level which was at the surface prior to dredging. In order to meet this recommendation the Corps will need to dredge deeper than the authorized depths shown on Plate 2 and also will need to dredge outside the limits of the channel to remove sediments next to piers and bulkheads. Alternatives have been investigated which include dredging deeper than authorized depths, extending the Corps' limits of dredging up to the 50 ppm PCB limit and the possibility of combining the efforts of the USEPA and COE cleanup programs.

b. Methods. Future dredging is generally expected to be performed by contract utilizing a clamshell dredge and scows. The loaded scows would be transported to an unloading area within the harbor from which the dredged materials would be rehandled into water tight trucks for transportation to the disposal site. Hydraulic dredging is not feasible due to distances to potential disposal sites and the requirement to treat and discharge large volumes of effluent. The Corps has recently investigated the use of modified clamshell dredging (closed bucket) and its effects on the resuspension of sediments. This simple and inexpensive modification has been shown effective in reducing the turbidity in the upper water column by 30-70%. The use of this modified clamshell will be considered by the Corps for Waukegan dredging.

c. Dredging Volumes. Plate 3 shows an outline of the harbor and boundaries which the USEPA established in 1981 for delineating areas of different sediment PCB concentrations. Also shown on Plate 3 by a dashed line is the boundary of the authorized Federal channel. For the purpose of determining the volume of dredge material to be disposed in the confined disposal facility, four alternatives are being considered. These are listed in Table 2 and the numbered areas are those shown on Plate 3. Sediments from area 6 can be disposed in Lake Michigan as has been done in the past or used for beneficial purposes such as beach nourishment. Results of sampling done by the Corps of Engineers in 1981 indicate that most of the sediments in Area 6 actually contain PCB concentrations of 1 ppm or less. These estimates of volumes to be disposed are based on the assumption that one dredging operation will remove all polluted sediment for the ten year period for which the capacity of the CDF is designed. Any other dredging done within the ten year period will not contain PCB concentration sufficient to require special containment. However, if PCB contaminated sediments in the upper harbor are not removed prior to or during the federal channel dredging, there is a possibility that PCB's would migrate to the Federal channel and cause a need for additional special confined disposal in future operations.

Table 2 Alternative plans for volumes of dredged material to be contained in CDF

Alternative	Description	Volume of dredged material (yd <sup>3</sup> )
A	Only sediments from dredging of authorized Federal Channel (Area 4)	60,000
B	All soft sediments within "Expanded Federal Channel" which includes areas adjacent to piers and bulk-heads and extends below authorized depths (Area 4)	163,000
C	All soft sediments between the 50 ppm PCB line and the 10 ppm PCB line (Areas 3 and 4)	187,500
D	All soft sediments between the 500 ppm PCB line and the 10 ppm PCB line (Areas 2, 3 and 4)	221,000

## 8. COORDINATION.

a. Previous Coordination. Coordination to locate and secure an acceptable disposal area for the dredging from Waukegan Harbor was begun in August 1982. The first series of meetings were conducted separately between the Corps of Engineers and Illinois Department of Transportation Division of Water Resources, Illinois Environmental Protection Agency, U.S. Environmental Protection Agency, Detroit District, Corps of Engineers, Waukegan Port District, Lake County Planning Commission and the Lake County Health Department. The purpose of these meetings was to solicit the various agencies assistance in the identification of potential sites. Additional inter-agency meetings were held on 9 February 1983 and 19 May 1983. Details on sites considered and eliminated are presented in paragraphs 10 and 11.

b. Future Coordination. The agencies listed below will be requested to comment on the analyses presented in this report. In addition, public input will be solicited at an informal workshop prior to selecting a final site.

- (1) United States Environmental Protection Agency (USEPA)
- (2) Illinois Department of Transportation (IDOT)
- (3) Waukegan Port District
- (4) Northeastern Illinois Planning Commission (NIPC)
- (5) Lake County Regional Planning Commission
- (6) Illinois Environmental Protection Agency (IEPA)
- (7) Lake Michigan Shoreline Advisory Committee
- (8) City of Waukegan
- (9) Illinois Department of Conservation
- (10) United States Fish and Wildlife Service
- (11) Governor of Illinois
- (12) Illinois Congressional Delegation
- (13) Board of Commissioners, Lake County, Illinois
- (14) Lake County Health Department

9. REQUIRED LOCAL COOPERATION. Construction of a disposal facility under the authority of Section 123 of PL 91-611 is subject to the provisions that local interests furnish assurances of certain items of local cooperation. The local sponsor must be a legally constituted public body with full authority and capability to perform the terms of the agreement and to pay damages, if necessary, in the event of failure to perform. The items of local cooperation are summarized as follows:

a. Furnish all lands, easements and rights-of-way necessary for the construction, operation and maintenance of the facility.

b. Contribute to the United States 25 percent of the construction costs, such amount to be payable either in cash prior to construction, in installments during construction, or in installments, with interest at a rate to be determined by the Secretary of the Treasury, as of the beginning

of the fiscal year in which construction is initiated, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations, which are neither due nor callable for redemption for fifteen years from date of issue.

c. Hold and save the United States free from damages due to construction, operation, and maintenance of the facility except for damages due to the fault or negligence of the United States or its contractors.

d. Maintain the facility after completion of its use for disposal purposes in a manner satisfactory to the Secretary of the Army.

e. The participating non-Federal interest or interests shall retain title to all lands, easements, and rights-of-way furnished by it pursuant to subparagraph a. above. A spoil disposal facility owned by a non-Federal interest or interests may be conveyed to another party only after completion of the facility's use for disposal purposes and after the transferee agrees in writing to use or maintain the facility in a manner which the Secretary of the Army determines to be satisfactory.

f. The requirements for the appropriate non-Federal interest or interests to furnish an agreement to contribute 25 percent of the construction costs as set forth in subparagraph b. above shall be waived by the Secretary of the Army upon a finding by the Administrator of the Environmental Protection Agency that for the area to which such construction applies, the State or States involved, interstate agency, municipality, and other appropriate political subdivision of the State and industrial concerns are participating in and in compliance with an approved plan for the general geographical area of the dredging activity for construction, modification, expansion, or rehabilitation of waste treatment facilities and the Administrator has found that applicable water quality standards are not being violated.

g. In acquiring lands, easements and rights-of-way for construction and subsequent maintenance of the project, the non-Federal interest will comply with the applicable provisions of the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," Public Law 91-646, approved 2 January 1971, and inform affected persons of pertinent benefits, policies and procedures in connection with said Act.

h. The non-Federal interests shall also comply with Section 601 of Title VI of the Civil Rights Act of 1964 (P.L. 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, in connection with the maintenance and operation of the project and the use of project lands.

#### 10. PLANS INVESTIGATED

a. General. With the assistance of other agencies, 15 alternative sites were selected to be evaluated for selection as a disposal location for material dredged from the navigation channel at Waukegan Harbor, Illinois. Of the original 15 sites nine were selected for further study.

Of those nine selected for further study three were selected for detailed study and evaluation for possible recommendation as the selected site. The three sites described below are sites 1, 4, and 16 with the location of each shown on Plate 4.

b. Site Number 1.

(1) Description: This site is in the SW quarter of Section 29, T46N, R12E, Waukegan, Illinois. The property for this site will be acquired by the Waukegan Port District to use as a clear zone for a proposed runway extension for the Waukegan Memorial Airport. The total area of the clear zone is 78.7 acres however Lewis Avenue and Wadsworth Road pass through the clear zone and divide it into much smaller parcels. The area proposed for site 1 is approximately 21 acres. It is a triangular area within the clear zone bounded by Lewis Avenue on the east and Wadsworth Road on the south. A plan view for the proposed dike alignment is shown on Plate 5. Site 1 is presently covered by brush, small trees and grass. The underlying soil is weathered residual till soil or a silty clay with fine to coarse sand and rounded gravel pebbles.

(2) Capacity: This site is capable of holding 187,500 cubic yards of dredge material with the height of the dike at 28.5 feet. Sufficient capacity would also be available for a 2-foot clay seal and 2 feet of topsoil after completion of dredging operations.

(3) Retaining Structures Required: An earth dike between 12.5 and 28.5 feet high would be required to retain the dredge materials depending on the volume of dredge material to be disposed. To avoid any migration of the polluted materials into the existing groundwater, a two foot thick clay liner would be required over the entire area as well as a liner of synthetic impervious material. A typical section of the earth dike is shown on Plate 7.

(4) Method of Dredging and Disposal: Dredging would most likely be performed by clamshell with the dredge materials placed into scows. These scows would then be transported to an unloading area in the harbor. The material would then be rehandled and placed into water tight trucks which will transport the sediments to the disposal site.

(5) Costs:

(a) Land Acquisition: The property which makes up site number 1 is currently owned or in the process of being acquired by the Waukegan Port District. Though no costs have been identified specifically for this site the costs for the disposal site and any easements would be a non-Federal cost.

(b) Construction Cost: The total cost of construction including dredging would depend on the volume of sediment to be disposed of in the CDF. Detailed cost estimates are contained in Appendix D.

(c) Maintenance Cost: The annual cost of maintaining the facility would be minimal after the CDF is capped and seeded. Maintenance would principally be mowing and maintaining fences and cost would not vary greatly depending on the site chosen.

(6) Environmental Assessment:

(a) Physical Resources and Impacts: The site is relatively high in elevation (680 to 710 feet above sea level) with no ponded or running surface water. Soils are high in clay content with probable low permeation rates and a low water table. Site permeability must be investigated to determine leaching potentials and additional groundwater protection needs. Site effluent handling and/or treatment requirements must be evaluated.

(b) Vegetation and Wildlife Resources and Impacts: Site 1 consists of a mixture of habitat types including agricultural fields, early and advanced old fields and a small old conservation project plantation of pine trees (Pinus sp.). The advanced old field contains perennial forbes, grasses, and scattered elm trees (Ulmus sp.). A small, low, wet patch within the field is vegetated to seed canary grass (Phalaris arundinacea). Residences along two of the site's perimeters are surrounded by mowed lawns and cultivated trees and shrubs. The U.S. Fish and Wildlife Service stated in a 30 August 1983 letter that the wildlife value of the site is fairly high in that it provides some habitat diversity in an area surrounded by urban and agricultural lands. Conversion of all or part of the site to a confined disposal area would have a significant impact on resident species due to habitat losses. Therefore, destruction of woody vegetation should be avoided where possible. Site capping must be evaluated to prevent entry of contaminants into the food chain.

(c) Social Setting and Impacts: Homes are scattered along the site's southern and eastern perimeters but would be removed as part of the proposed extension of the Waukegan Memorial Airport. The area surrounding the site is scattered residential and undeveloped open space. Provided the existing houses are displaced by the airport expansion, no significant social impacts are anticipated. Potential haul routes for dredge material from dredge sites to the disposal site should be mapped to minimize disruptive impacts.

(d) Cultural Resources and Impacts: No known archaeological studies have been made at the site. Shovel-testing of the site is needed before drawing any conclusions regarding the presence of archaeological or historic resources.

c. Site number 4.

(1) Description: Site 4 is located in the NW corner of Section 18 and the SW quarter of Section 7 of T46N, R12E, unincorporated Lake County, Illinois. The site is an 80-acre agricultural field bounded by 9th

Street on the north and by Green Bay Road (Rt. 131) on the west. Zion, the closest community, is to the east. The area consists of gently sloping to steeply sloping agricultural lands with well to moderately well drained deep soils and moderate to moderately slow permeability. The soil appears to be derived from morainal silty clay till with sand and rounded pebbles or gravel. Ground elevations range from 700 to 730 ft. above sea level with bedrock approximately 200 feet below the surface.

(2) Capacity: This site is capable of holding any of the proposed disposal alternatives up to 221,000 cubic yards of dredge material. Sufficient capacity would also be available for a 2-foot clay seal and 2 feet of topsoil after completion of dredging operations.

(3) Retaining Structures Required: An earth dike from approximately 21.5 feet to 26.5 feet high would be required to retain the dredge materials. To avoid any migration of the polluted materials into the existing groundwater, a two foot thick clay liner would be required beneath the dredge material, as well as a liner of synthetic impervious material. A typical section of the earth dike is shown on Plate 7. For site 4 the optimum dike alignment would form a square shape.

(4) Method of Dredging and Disposal: Dredging would most likely be performed by clamshell with the dredge materials placed into scows. These scows would then be transported to an unloading area in the harbor. The material would then be rehandled and placed into water tight trucks which will transport the sediments to the disposal site.

(5) Costs:

(a) Land Acquisition: The property which makes up site number 4 is owned privately and would have to be purchased by the local sponsor. Land within site 4 could be purchased for approximately \$8,400 per acre.

(b) Construction Cost: The total cost of construction, including dredging, would depend on the volume of sediment to be disposed in the CDF. Detailed cost estimates are contained in Appendix D.

(c) Maintenance Cost: The annual cost of maintaining the facility would be minimal after the CDF is capped and seeded. Maintenance required would principally be mowing and maintaining fences and cost would not vary greatly depending on the site chosen.

(6) Environmental Assessment:

(a) Physical Resources and Impacts: The site is relatively high in elevation (710-730 feet above sea level) with no ponded or running surface water. The area consists of well to moderately well drained deep soils and moderate to moderately slow permeability. Soils are Miami Silt Loam, Montmorenci Silt Loam, Pella Silty Clay Loam, Beecher Silt Loam, Peotone Silty Clay Loam, Barrington Silt Loam, Corwin Silt Loam Grays and

Markham Silt Loams, Barrington and Varna Silt Loams and Mundelein and Elliot Silt Loams. The soil appears to be derived from morainal silty clay till with sand and rounded pebbles or gravel. Bedrock is about 500 feet above sea level or over 200 feet below the surface. The disposal facility design, including effluent handling or treatment, would have to include, measures to assure groundwater protection.

(b) Vegetation and Wildlife Resources and Impacts: Crop field can have value to wildlife as an auxillary or cold weather food source except that, in this case, there is essentially no interspersation of other habitat types around the site to provide the remainder of their life requirements. For example, deer and raccoon often feed in corn fields but require woods for reproduction. Pheasants too feed in corn but nest in brush and grass often found along fencerows. Some species such as crows and blackbirds will undoubtedly make use of the crop field although they are considered pest species. A few songbirds may make use of the trees found on the site. In total, the U.S. Fish and Wildlife Service has rated the site quite low in wildlife value. Since the site is currently of low value to wildlife, the impact of its use as a disposal site is insignificant. Depending on how the site is reclaimed following use habitat values could actually be increased for a variety of wildlife species.

(c) Social Setting and Impacts: The site is cropland. The surrounding area includes agricultural land, landfills (Browning Ferris and the North Shore Sanitary District) and open space. Zion is the closest community. Displacement of a farm is the primary social impact forseen. A determination as to whether the site includes any prime or unique farmland would have to be made in cooperation with other federal and state agencies.

(d) Cultural Resources and Impacts: A cursory examination of the northern portion of the 80-acre site revealed only a few non-cultural fragments of poor quality tan-white chert. Shovel-testing of the site or examination while the surface is exposed after plowing is needed before drawing any conclusions regarding the presence of archaeological or historic resources.

d. Site Number 16.

(1) Description: Site 16 is located in the NE quarter of Section 22, T 45N, R 12E, Waukegan, Illinois. The site lies between Waukegan Harbor and Lake Michigan. Although owned by Outboard Marine Corporation it apparently sits idle or is used for temporary storage of materials and parking. The surface soils are aeolian dune sands generally very fine to fine grained overlying transgressing beach sands which are fine to coarse grained. The dune sands are very loose to medium dense while the beach sand is loose to dense. Borings at site 16 found glacial till at elevations of -25 to -30 feet LWD. The glacial till is a sandy silty clay with gravel and high carbonate content.

(2) Capacity: This site is capable of holding 187,500 cubic yards of dredge material with capacity available for a 2-foot clay seal and 2 feet of topsoil after completion of dredging operations.

(3) Retaining Structures Required: An earth dike from approximately 21.5 feet to 26.5 feet high would be required to retain the dredge materials. To avoid any migration of the polluted materials into the existing groundwater, a two foot thick clay liner would be required beneath the dredge material as well as a liner of synthetic impervious material. A typical section of the earth dike is shown on Plate 7. Plate 6 is a plan view showing a proposed dike alignment.

(4) Method of Dredging and Disposal: Dredging could be preformed by clamshell or hydraulic dredge. If the material were to be dredged hydraulically the use of a dewatering facility would be necessary.

(5) Costs:

(a) Land Acquisition: The property which makes up site number 16 is currently owned by the Outboard Marine Corporation and would have to be acquired by the local sponsor. An exact value has not been identified for the site, however, land cost has been estimated to be about \$3.00 per square foot.

(b) Construction Cost: The total cost of construction including dredging would depend on the volume of sediment to be placed in the CDF. Detailed cost estimates are contained in Appendix D.

(c) Maintenance Cost: The annual cost of maintaining the facility would be minimal after the CDF is capped and seeded. Maintenance would principally be mowing and maintaining fences and cost would not vary greatly depending on the site chosen.

(6) Environmental Assessment:

(a) Physical Resources and Impacts: The predevelopment terrain consisted of coastal dunes with a marsh or swampy area underlying a bluff which represents a lake terrace or former shoreline of ancient Lake Michigan. The permeability of the site's soils would have to be determined and groundwater protection requirements determined for the disposal facility design specifications.

(b) Vegetation and Wildlife Resources and Impacts: Site 16 is characterized by being flat with no standing or running water and is vegetated by a variety of weedy grass and forb species which are periodically mowed. It is of low value to wildlife although it does provide some food and cover for various birds and small mammals. The use of the site for dredge disposal would have little impact on wildlife resources.

(c) Social Setting and Impacts: The site is in an industrial area north of the Waukegan Harbor entrance. A waterworks facility is between the site and the entrance to the federal channel. Further north beyond the site is a waste treatment plant. A public beach and beach house are along the Lake Michigan shoreline to the east, but are separated from

site 16 by a harbor access road. It should be possible to minimize or avoid disturbing the beach area during dredging and disposal operations. No significant social impacts are anticipated from disposal, but future development of the site may be affected.

(d) Cultural Resources and Impacts: Borings taken in June 1983 show that the site consists of modern fill (slag and gravel) to a depth between five and twelve feet. The site has been graded flat; it is not likely to contain intact or significant archaeological or historical resources.

#### 11. OTHER SITES DISCUSSED:

a. General: A total of 15 sites were originally identified to be considered in the search for an acceptable dredge confinement facility. All but three sites were rejected for various reasons prior to the detailed analysis of this report. These sites are shown on Plate 4 and are briefly summarized below.

b. Site No. 2. This site is an existing sanitary landfill located near the Waukegan airport and currently owned by the Waukegan Port Authority. This site was rejected by agency meeting on 9 February 1983 based on additional costs needed to repair a present leaching problem at the landfill and the proximity of a school and residential areas.

c. Site No. 3. This site is the existing confined disposal facility at Kenosha, Wisconsin. The site was deleted from the list by agency meeting dated 19 May 1983 after being informed by the COE Detroit District that the Wisconsin DNR would not go along with the disposal of the Waukegan material at Kenosha for environmental reasons.

d. Site No. 5. This is the North Shore Sanitary District Landfill, which is currently being used. The community of Zion is to the east of the site. The site is bounded on the east by Green Bay Road (Rt. 131) and 9th Street on the north. At the request of the property owner this site has been eliminated from further consideration.

e. Site No. 6. This site is a landfill owned by Browning-Ferris and was selected for further study at an Interagency meeting held on 19 May 1983. After further study this office determined that though it provided an effective means of disposal it could not be implemented under the Section 123 diked disposal authority. The possibility for funding the project within this commercial site by utilizing continuing operation and maintenance funds was considered. However, justification for the use of these funds is based on the total yearly commercial tonage that is handled by the harbor. Unfortunately Waukegan Harbor's yearly commercial tonage is approximately 150,000 tons and will only justify \$150,000 of the construction costs. Therefore, this site was deleted from further consideration.

f. Site No. 7. This site was determined to also be Site No. 14.

g. Site No. 8. The Chicago CDF was considered in the initial phase of study but was determined not to have sufficient excess capacity to accommodate the Waukegan material and was not designed for PCB laden material. For these reasons the deletion of site 8 was concurred to by agency meeting dated 9 February 1983.

h. Site No. 9. This site is a water site located in Lake Michigan and adjacent to the south jetty wall of Waukegan Harbor. The site was selected for further study at an Interagency meeting held on 9 February 1983. After further study it was decided at the Interagency meeting dated 19 May 1983 that the site should be dropped from further study due to its interruption of the Waukegan river and the inability to meet the effluent treatment standards of Lake Michigan.

i. Site No. 10. This site is along the shoreline of Lake Michigan south of Waukegan Harbor in the vicinity of the old railroad turning house. This site was eliminated at the Interagency meeting dated 19 May 1983 due to the stringent limitations it would impose upon future usage and development of the waterfront location.

j. Sites No. 11, 12, 13A, and 13B. These sites are sections of property owned by the Lake County Forest Preserve and were eliminated from consideration as confined dredge disposal sites at the request of the owners.

k. Site No. 14. This site is an old landfill adjacent to 14th Street and was eliminated from further consideration due to the limited disposal capacities available and the necessity to excavate and dispose of existing landfill material.

l. Site No. 15. This site is between the existing and proposed northeast-southwest paved runways at the Waukegan Memorial Airport. The site is presently a grass covered, clear zone. It was eliminated from further consideration due to the limitations on disposal capacity and probable interruption of existing utilities.

## 12. COST COMPARISONS

### a. Dredging Costs:

(1) Previous Costs: Dredging at Waukegan Harbor used to be performed by mechanical dredges with the dredged materials transported in bottom dump scows to the authorized dumping area in Lake Michigan. The cost of this practice based on present day prices is approximately \$5.70/cubic yard.

(2) Project Costs: Cost for future dredging depends on which site is selected because of the different hauling distances required. For Site 1 the cost is expected to be approximately \$11.00 per cubic yard, for Site 4 \$12.00 per cubic yard and for Site 16 \$6.50 per cubic yard.

b. Estimated Construction Costs: Estimates for the various proposals are presented in Appendix D and are summarized below in Tables 3, 4, 5 and 6.

Table 3 Cost comparisons for 60,000 cy capacity CDFs  
costs in thousands of dollars

	Site 1	Site 4	Site 16
Construction of CDF	2649	2649	2649
Interest during construction	108	108	108
Real Estate (7.5 acres)	0	63	980
Dredging and Hauling	<u>914</u>	<u>991</u>	<u>556</u>
Total	3671	3811	4293
Cost per cubic yard of dredge material (\$/cy)	61.20	63.50	71.60

Table 4 Cost comparison for 163,000 cy capacity CDFs  
costs in thousands of dollars

	Site 1	Site 4	Site 16
Construction of CDF	5190	5190	5190
Interest during construction	210	210	210
Real Estate (13.4 acres)	0	113	1751
Dredging and Hauling	<u>2330</u>	<u>2536</u>	<u>1406</u>
Total	7730	8049	8557
Cost per cubic yard of dredge material (\$/cy)	47.40	49.40	52.50

Table 5 Cost comparisons for 187,500 cy capacity CDFs  
costs in thousands of dollars

	Site 1	Site 4	Site 16
Construction of CDF	5716	5716	5716
Interest during construction	232	232	232
Real Estate (14.5 acres)	0	122	1895
Dredging and Hauling	<u>2668</u>	<u>2904</u>	<u>1605</u>
Total	8616	8974	9448
Cost per cubic yard of dredge material (\$/cy)	45.90	47.90	50.40

Table 6 Comparison of cost for 221,000 cy capacity CDFs  
costs in thousands of dollars

	Site 1	Site 4	Site 16
Construction of CDF	(1)	6403	6403
Interest during construction		260	260
Real Estate (16.2 acres)		136	2117
Dredging and Hauling		<u>3406</u>	<u>1878</u>
Total		10,205	10,658
Cost per cubic yard of dredge material (\$/cy)		46.20	48.20

(1) Site 1 does not have sufficient area to accommodate a CDF with 221,000 cy design capacity.

13. COST ALLOCATION. All costs of construction of any of the discussed disposal sites at Waukegan Harbor are attributed to water quality and as such are a Federal responsibility subject only to the provisions of the required local cooperation.

#### 14. CONTRIBUTION BY LOCAL INTERESTS.

a. According to the authorizing laws, local interests are required to contribute 25% of the construction cost if no waiver, as described in paragraph 9f above, can be obtained. In response to the request for a ruling, the U.S. EPA has stated that the area has a certified and approved Water Quality Management Plan, and that all major discharges in the area are in compliance with their NPDES (National Pollution Discharge Elimination System) permits. Therefore, under paragraph (d) of Section 123 of P.L. 91-611, the Secretary of the Army can waive the requirement that the local sponsor contribute 25% of the construction cost.

#### 15. DISCUSSIONS

The analysis performed to date indicate that the decision as to which site should be recommended has to consider construction costs, operation and maintenance costs, capping costs, dredging costs, probable environmental impacts, possible enhancements, and the desires and needs of the City, County, State, Federal agencies and the general public. Table 7 is a summary of additional advantages and disadvantages associated with each site.

Table 7  
Advantages and Disadvantages of the Sites

Site No.	Advantages	Disadvantages
1.	Ownership by Waukegan Port District.	High dike required. Possible interference for aircraft.
4.	Adjacent to existing landfills.	
16.	Close proximity to dredging operation.	High dike required. Limits future use of lakefront property.

16. U.S. ENVIRONMENTAL PROTECTION AGENCY PROJECT. The USEPA has conducted a feasibility study to evaluate cleanup alternatives for the PCB contamination in Waukegan Harbor. The feasibility study was completed in July 1983 under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 1980. The portion of the EPA's project which is most closely associated with that of the Corps of Engineers' project is the action that will be taken in Slip No. 3 and the

Upper Harbor. Within this action a containment wall would be constructed around the perimeter of the western portion of Slip No. 3 and part of the Upper Harbor sediments would be dredged and placed in the contained area. The containment area would then be capped.

17. Combined EPA-Corps of Engineers' Project. By legal authority the Corps of Engineers is limited to dredging only the federal channel in Waukegan Harbor. Maintenance dredging to be done by COE would only include Alternative A (see Table 2). Additional authorization would have to be obtained for COE to perform any of the other alternatives. The position of the USEPA Officer of Environmental Review on dredging of PCB contaminated sediments is that following dredging, the level of PCB at the exposed surface of the sediment should not be greater than that which was at the surface before dredging. This position is stated in a memorandum from the USEPA Environmental Review Staff to the OMC Task Force Members dated 30 October 1981. This position was reaffirmed by USEPA at a meeting 29 September 1982 in clarification of a USEPA letter to the COE, Chicago District Engineer dated 30 August 1982.

According to a report submitted to the USEPA by Mason and Hanger - Silas Mason Co. in January 1981 the entire top soft muck sediment layer is contaminated with PCB down to the underlying sand at almost all locations where any PCB contamination occurs. This report and conclusion has been accepted by the USEPA. Therefore in order to satisfy the requirement that PCB concentrations exposed after dredging not exceed those at the surface prior to dredging all soft muck sediments would have to be removed. Mr. Hooper reaffirmed this conclusion in a conversation with Mr. Rodney Lynn, Study Manager for Chicago District COE on 5 October 1982. It seems probable therefore that if COE does any dredging in Waukegan Harbor it will, at the least, have to dredge all soft muck sediments from the Federal Channel which will exceed the present authorization for dredging by COE.

The USEPA and Illinois EPA have identified only those areas contaminated with more than 50 ppm PCB for clean-up. The net result is that the area between the Corps project and EPA project will remain untouched and contaminated unless some effort can be initiated to clean it up.

If this area is not dredged at the same time or prior to the time the Federal Channel is dredged, PCB will migrate to the Federal Channel and dredge material from future maintenance dredging will very likely contain more than 10 ppm PCB and require confined disposal. The amount of contaminated material and the number of times in the future that routine maintenance dredgings will contain contaminated material cannot be accurately predicted. However, it would be much more economical to clean up the entire harbor at once rather than deal with the PCB contamination in maintenance dredging year-after-year.

18. LOCAL SPONSOR. At the present time no local sponsor has been identified.

19. ~~CONCLUSION.~~ No recommendation is being made as to which of the sites is to be used for the dredgings from Waukegan Harbor. Only the facts and costs being presented in this site selection study. Which of the sites ultimately recommended will be based on consideration of construction and operation costs, environmental impacts, and the desires and concerns of a local sponsor, local and Federal agencies and the general public. Comments and/or recommendations are being requested in response to this document and will again be requested as follows:

Public Workshop	-	June 1984
Draft Environmental Impact Statement	-	December 1984
Final Environmental Impact Statement	-	September 1985

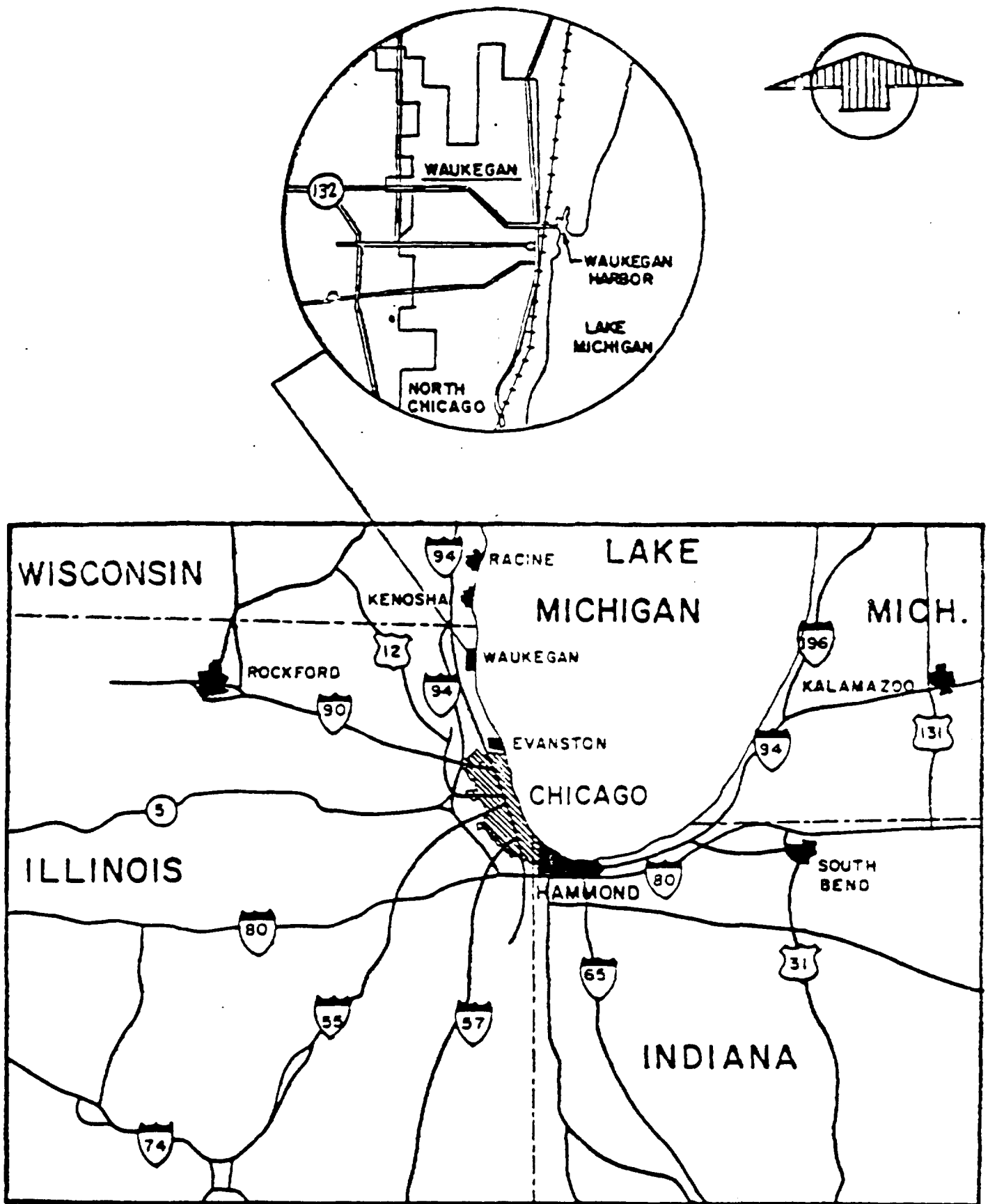
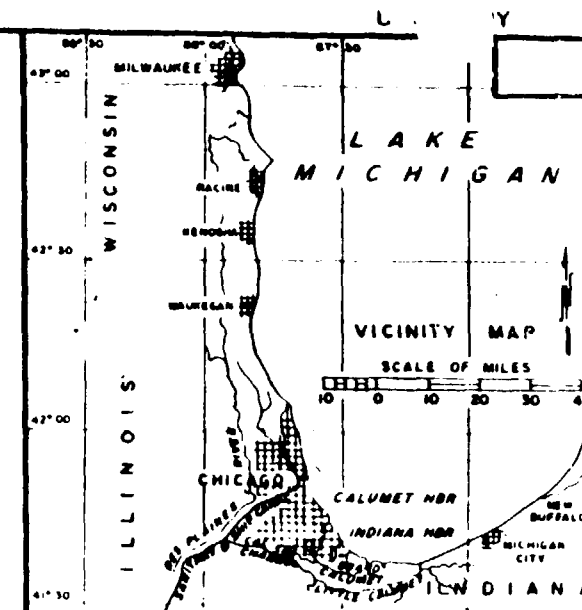


PLATE 1

GENERAL LOCATION MAP

TEERS



 CURRENTLY AUTHORIZED FEDERAL CHANNEL

WAUKEGAN HARBOR,  
ILLINOIS



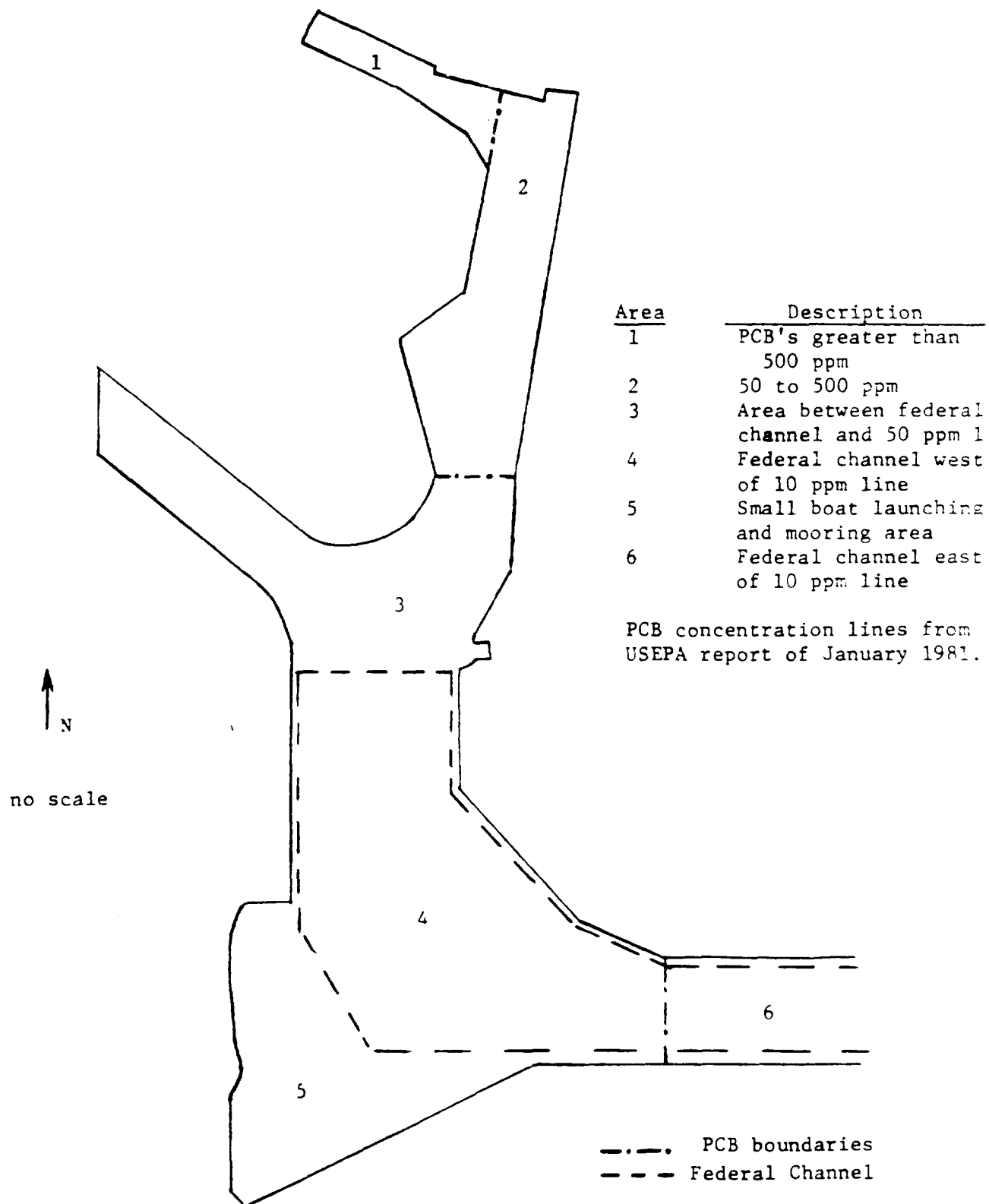
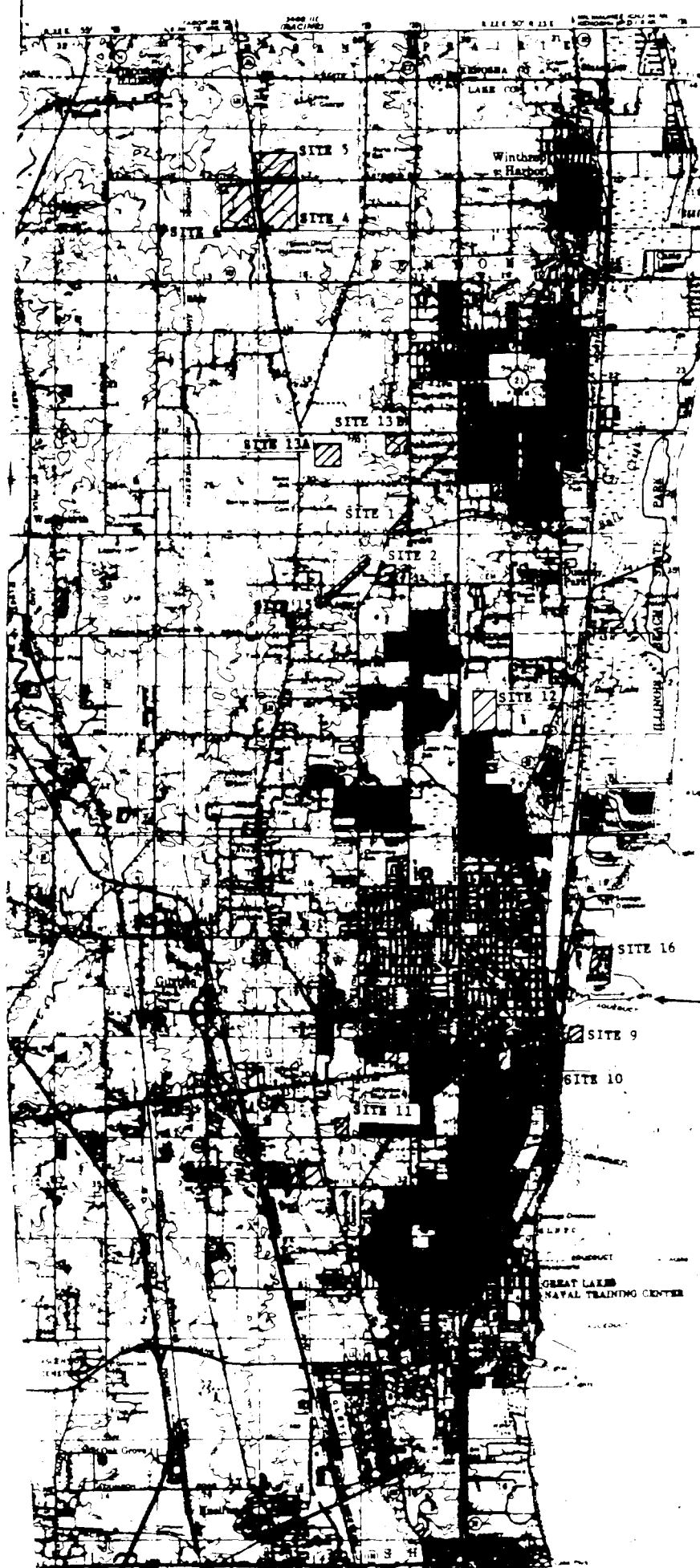


PLATE 3

Waukegan Harbor, Illinois  
 Areas considered for clean-up operations



SITE 3  
Kenosha CDF  
16 miles North

M I C H I G A N

WAUKEGAN HARBOR

SITE 8  
Chicago Area CDF  
17 miles South

PLATE 4

Location Map of Disposal Sites

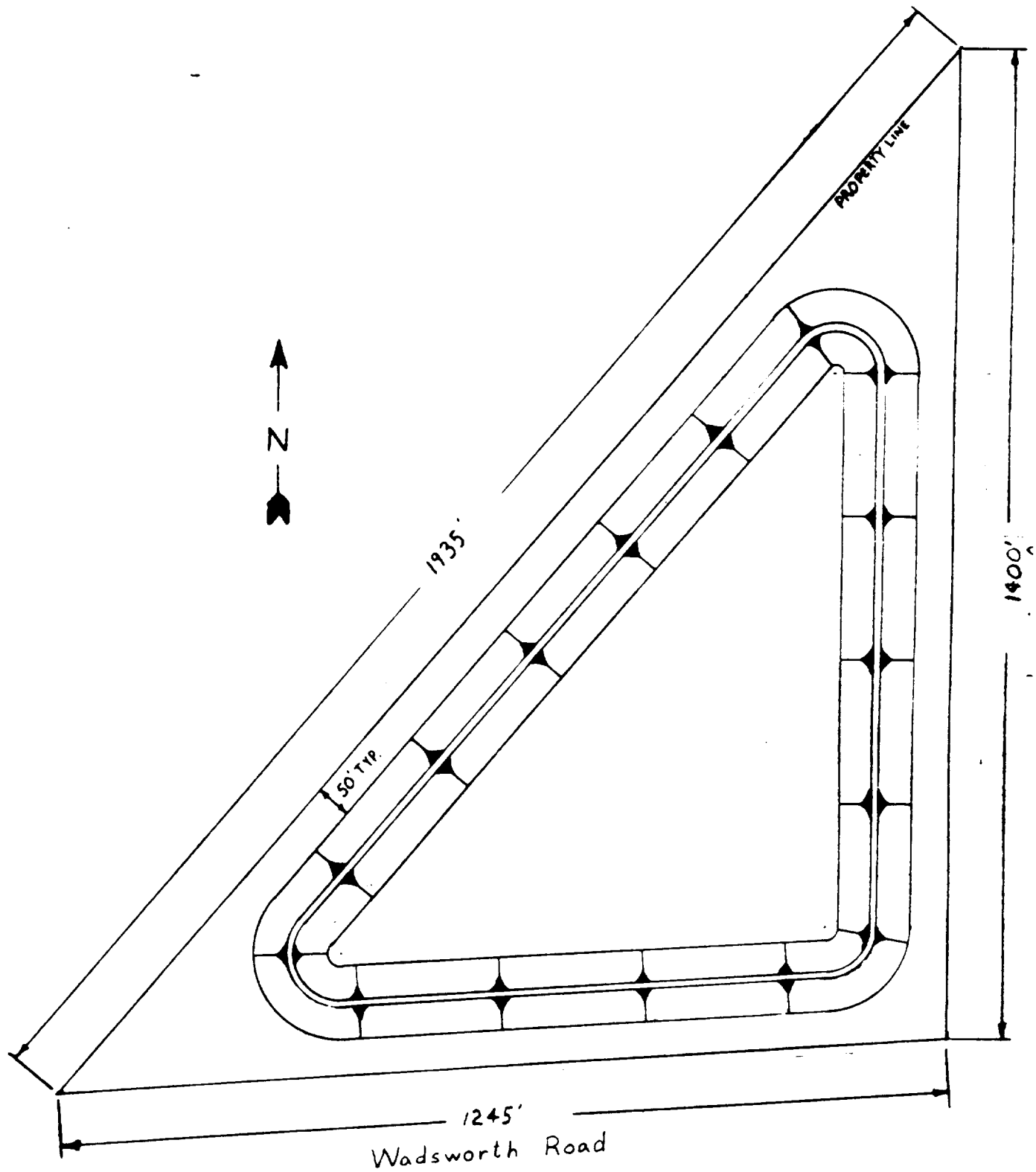
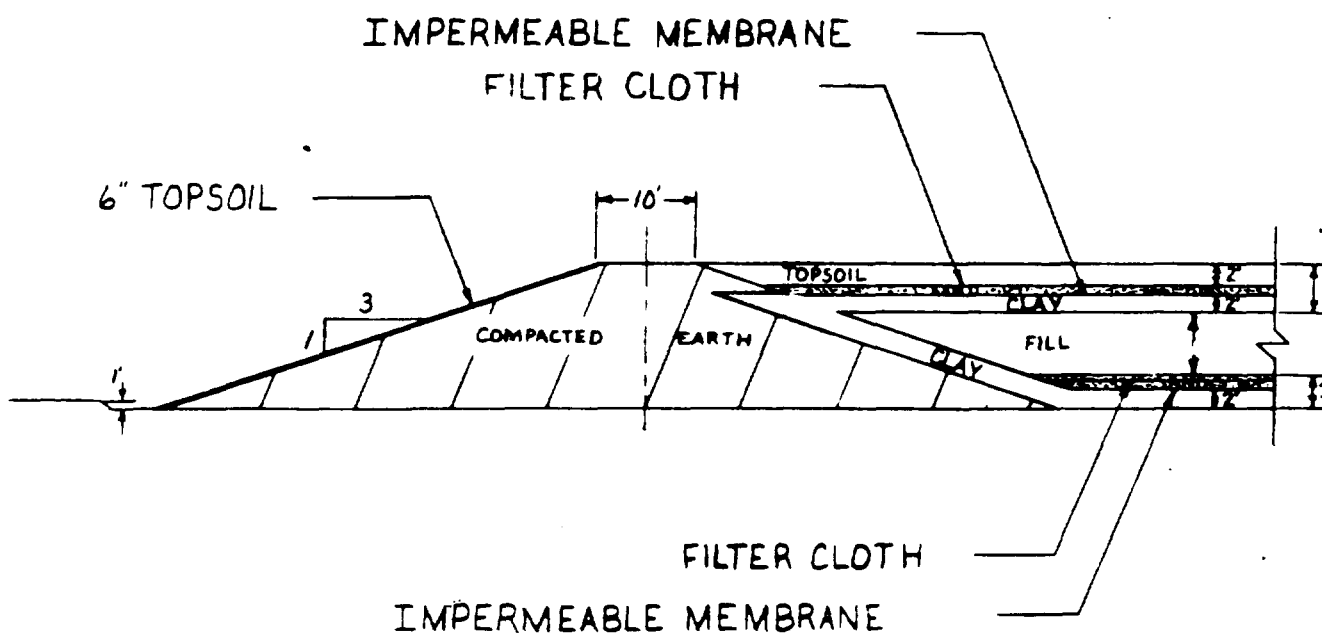


PLATE 5

WAUKEGAN HARBOR CDF  
SITE #1  
AIRPORT CLEAR ZONE  
PLAN VIEW  
2/17/83 1"=200'





100,000 CY CAPACITY

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX A  
SECTION 123, P.L. 91-611

Sec. 123. (a) The Secretary of the Army, acting through the Chief of Engineers, is authorized to construct, operate, and maintain, subject to the provisions of subsection (c), contained spoil disposal facilities of sufficient capacity for a period not to exceed ten years, to meet the requirements of this section. Before establishing each such facility, the Secretary of the Army shall obtain the concurrence of appropriate local governments and shall consider the views and recommendations of the Administrator of the Environmental Protection Agency and shall comply with requirements of section 21 of the Federal Water Pollution Control Act, and of the National Environmental Policy Act of 1969. Section 9 of the River and Harbor Act of 1899 shall not apply to any facility authorized by this section.

(b) The Secretary of the Army, acting through the Chief of Engineers, shall establish the contained spoil disposal facilities authorized in subsection (a) at the earliest practicable date, taking into consideration the views and recommendations of the Administrator of the Environmental Protection Agency as to those areas which, in the Administrator's judgment, are most urgently in need of such facilities and pursuant to the requirements of the National Environmental Policy Act of 1969 and the Federal Water Pollution Control Act.

(c) Prior to construction of any such facility, the appropriate State or States, interstate agency, municipality, or other appropriate political subdivision of the State shall agree in writing to (1) furnish all lands, easements, and rights-of-way necessary for the construction, operation, and maintenance of the facility; (2) contribute to the United States 25 per centum of the construction costs, such amount to be payable either in cash prior to construction, in installments during construction, or in installments, with interest at a rate to be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which construction is initiated, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations, which are neither due or callable for redemption for fifteen years from date of issue; (3) hold and save the United States free from damages due to con-

struction, operation, and maintenance of the facility; and (4) except as provided in subsection (f), maintain the facility after completion of its use for disposal purposes in a manner satisfactory to the Secretary of the Army.

(d) The requirement for appropriate non-Federal interest or interests to furnish an agreement to contribute 25 per centum of the construction costs as set forth in subsection (c) shall be waived by the Secretary of the Army upon a finding by the Administrator of the Environmental Protection Agency that for the area to which such construction applies, the State or States involved, interstate agency, municipality, and other appropriate political subdivision of the State and industrial concerns are participating in and in compliance with an approved plan for the general geographical area of the dredging activity for construction, modification, expansion, or rehabilitation of waste treatment facilities and the Administrator has found that applicable water quality standards are not being violated.

(e) Notwithstanding any other provision of law, all costs of disposal of dredged spoil from the project for the Great Lakes connecting channels, Michigan, shall be borne by the United States.

(f) The participating non-Federal interest or interests shall retain title to all lands, easements, and rights-of-way furnished by it pursuant to subsection (c). A spoil disposal facility owned by a non-Federal interest or interests may be conveyed to another party only after completion of the facility's use for disposal purposes and after the transferee agrees in writing to use or maintain the facility in a manner which the Secretary of the Army determines to be satisfactory.

(g) Any spoil disposal facilities constructed under the provisions of this section shall be made available to Federal licensees or permittees upon payment of an appropriate charge for such use. Twenty-five per centum of such charge shall be remitted to the participating non-Federal interest or interests except for those excused from contributing to the construction costs under subsections (d) and (e).

(h) This section, other than subsection (i), shall be applicable only to the Great Lakes and their connecting channels.

(i) The Chief of Engineers, under the direction of the Secretary of the Army, is hereby authorized to extend to all navigable waters, connecting channels, tributary streams, other waters of the United States and waters contiguous to the United States, a comprehensive program of research, study, and experimentation relating to dredged spoil. This program shall be carried out in cooperation with other Federal and State agencies, and shall include, but not be limited to, investigations on the characteristics of dredged spoil, and alternative methods of its disposal. To the extent that such study shall include the effects of such dredge spoil on water quality, the facilities and personnel of the Environmental Protection Agency shall be utilized.

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX B  
CHARACTER OF DREDGED MATERIAL

APPENDIX B  
CHARACTER OF DREDGED MATERIAL

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B-1	Results of bulk chemical and standard elutriate analysis of sediment samples collected from Waukegan Harbor in October 1981
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## 1. Purpose

This appendix will summarize the physical and chemical character of bottom sediments in Waukegan Harbor, Waukegan, Illinois to be included in the maintenance dredging proposed by the Corps of Engineers.

## 2. Study Limits

2.1 A map of Waukegan Harbor is shown on Plate B-1. The federal channel extends from just below slip #1, including the turning area and main channel between the north and south piers, to beyond the U.S. breakwater. The only recent dredging (1982) from the federal channel was from the entrance channel southeast of the breakwater. The authorized project depth of the entrance channel (eastward of the end of the north pier) is -22 feet Low Water Datum (LWD). The project depth for the remainder of the federal channel is -18 feet LWD. The Chicago District is not currently authorized to dredge beyond the defined limits of the federal channel, except for an allowable two-foot pay prism (overdepth).

2.2 The USEPA, as part of the SUPERFUND clean-up of PCB's in and around Waukegan Harbor has proposed dredging bottom sediments from areas of the "upper harbor" north of the federal channel.

## 3. Bottom Sediment Sampling and Analysis

3.1 Prior to 1976, routine analysis of bottom sediments from Waukegan Harbor was performed by the Corps of Engineers and the USEPA/Federal Water Pollution Control Administration in relation to maintenance dredging. Sediments were commonly analyzed for organic nutrients and heavy metals. The sediments of the inner harbor (project depth -18 ft LWD) were considered polluted and not acceptable for open-water disposal. Those sediments from the outer harbor (project depth -22 ft LWD) were considered only slightly polluted. In 1976, the USEPA first discovered the presence of polychlorinated biphenyls (PCB's) in Waukegan Harbor.

3.2 Prior to the maintenance dredging from the outer entrance channel in 1982, the Chicago District conducted analysis of the sediments (reference 5.2). The material was fine grained sand, presumably littoral drift, with concentrations of PCB's all less than one part per million (ppm).

3.3 In 1981, the Chicago District conducted a sampling program on the bottom sediments from the federal channel at Waukegan Harbor (reference 5.3). Borings and grab samples of sediment were collected for physical and chemical analysis, standard elutriate testing, and bioassays. The results of bulk chemical and standard elutriate analysis from this sampling program are provided as Attachment B-1. Also provided in this attachment is a plate showing the locations of sediment samples.

3.4 In 1982, the Chicago District collected grab samples of sediment from the upper end of the federal channel and the area around slip #1. In addition, borings were made to determine the depth of soft silty "muck" overlying the lake bed or till. The sediment samples were used for modified elutriate testing. The results were reported in reference 5.4.

3.5 Physically the bottom sediments of the federal channel at Waukegan Harbor are of two basic types. The bottom sediments along the north pier and in the entrance channel--are mostly sand and silty-sand. These locations are shown as Area 1 on Plate B-2. These sediments most probably represent littoral drift, or sand blown over the north pier from the beach area above of the harbor. The second basic type of bottom sediments in Waukegan Harbor are sandy-clay and silts present in the inner harbor areas. These locations are shown as Area 2 on Plate B-2.

3.6 Chemically, the sediments of Waukegan Harbor will be evaluated based on the USEPA "Guidelines for the Pollutational Classification of Great Lakes Harbor Sediments" (reference 5.5). These guidelines were developed to meet the need for "immediate decisions regarding the disposal of dredged material." The guidelines are based on several assumptions including:

"The variability of the sampling and analytical techniques is such that the assessment of any samples must be based on all factors and not on any single parameter with the exception of mercury and polychlorinated biphenyls (PCB's)."

3.7 The sand and silty-sand sediments of Area 1 were generally non-polluted with metals or organic contaminants. A summary of the pollution classification of samples from this area is shown on Table B-1.

3.8 The sandy-clay and silty sediments of the inner harbor areas are characterized as "moderately" to "heavy polluted" with some heavy metals and "moderately polluted" with organic content and nutrients. A summary of the polluttional classification of sediment samples collected from Area 2 is shown on Table B-2.

3.9 The concentrations of PCB's in the bottom sediments of Waukegan Harbor varies with location and depth. The USEPA report (reference 5.1) divided the harbor into areas of specific PCB concentrations. Plate B-3 is reproduced from this report. All areas of the Federal channel are identified as having PCB concentrations less than 50 ppm. Grab and core samples of the sandy-clay and silty sediments of the inner harbor (Area 2) contained PCB levels well below 50 ppm (references 5.3 and 5.4). Analysis of the silty-sand and sand from Area 1 showed PCB concentrations less than 1.0 ppm throughout.

3.10 Elutriate tests are designed to demonstrate the release or solubilization of contaminants during dredging and/or disposal. The standard elutriate test was developed to evaluate the impacts of open water disposal of dredged materials. A sediment and water mixture is prepared and agitated. The soluble fraction is then analyzed for contaminants. Standard elutriate tests conducted with Waukegan Harbor sediments (reference 5.3) demonstrated little or no release of contaminants into solution. These results are in agreement with the findings of the Corps' Dredged Material Research Program which conducted exhaustive testing of dredged material around the country. Most heavy metals were found to be tightly bound to the silty-clay particles of urban sediments.

3.11 Chlorinated hydrocarbons are very hydrophobic substances. PCB's in the environment are adsorbed onto soil/sediment particles. In Waukegan Harbor the PCB's present are tightly bound to the organic silts and clays of the upper harbor and are not readily leached into solution.

#### 4. Disposal and Treatment

4.1 The bottom sediments from Waukegan Harbor within the Federal channel need to be dredged in order to maintain the authorized navigation depth. Using depth surveys of 1981, the volume of material above project depth (plus a 2-foot pay prism allowance) in Area 1 was estimated as about 45,000 yd<sup>3</sup>. Because these materials are generally sand and silty-sand with little or no organic or metal contaminants and no PCB's (<1 ppm), the disposal options available could include open water disposal, beach nourishment, or use as a construction fill.

4.2 The volume of sandy-clay and silty sediments above project depth (plus 2-foot allowance) in Area 2 was estimated as about 60,000 yd<sup>3</sup>. The Corps' is currently considering the disposal of these dredged materials in an upland confined facility. These sediments have an average moisture content of about 50% (in place) and a specific gravity of between 2.5 and 2.7. Mechanical dredging of Waukegan Harbor bottom sediments will allow the disposal of these materials with little additional water.

4.3 The dewatering/densification of dredged material will immediately follow disposal. The dewatering can occur by evaporation, decanting of the surface water, underdrainage, progressive trenching, or by a combination of these. Water drained from the disposal area can be treated by filtration or coagulation if the concentration of suspended solids is excessive.

4.4 Corps' sponsored research under the Dredged Material Research Program has shown that dredged material can dry to a moisture content equal to about 1.2 times its plastic limit (about 20-25% moisture in the case of Waukegan sediments). Dredged material once dewatered is fairly stable in terms of acid/base conditions. The dredged material can be capped with a clay layer and the disposal area completed.

#### 5. References

5.1 The PCB Contamination Problem in Waukegan, Illinois, USEPA Region V, 21 January 1981.

5.2 Waukegan Outer Harbor Sediment Analysis, U.S. Army Corps of Engineers, Chicago District, 5 June 1981.

5.3 Waukegan Harbor, Illinois; Analysis of Sediment Samples collected in October 1981, U.S. Army Corps of Engineers, Chicago District, May 1982.

5.4 Waukegan Harbor, Illinois; Analysis of Sediment Samples collected in November 1982, U.S. Army Corps of Engineers, Chicago District, February 1983.

5.5 Guidelines for the Pollutational Classification of Great Lakes Harbor Sediments, USEPA Region V, 1977.

Table B-1 Summary of pollution classification  
of sediment samples from Area 1.

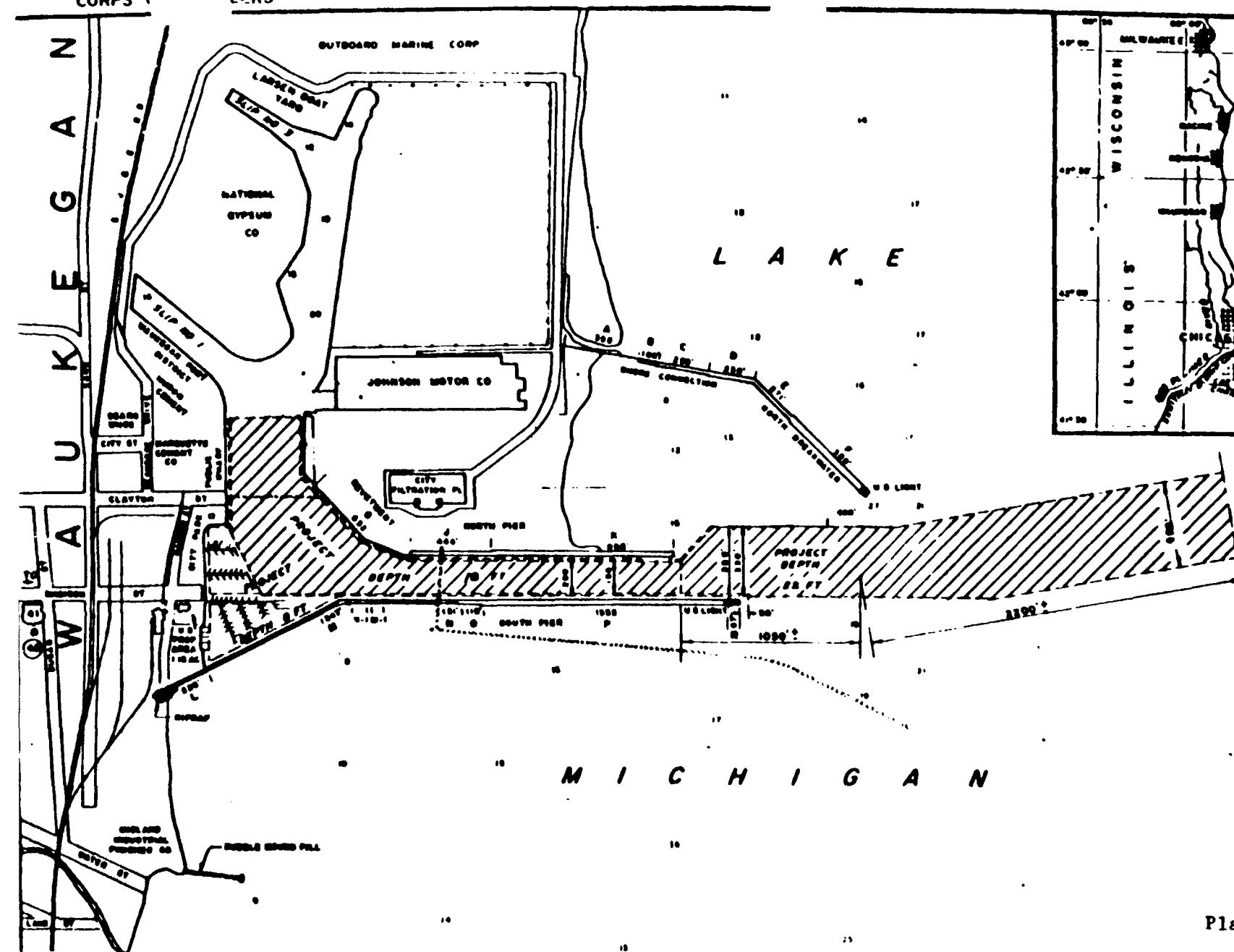
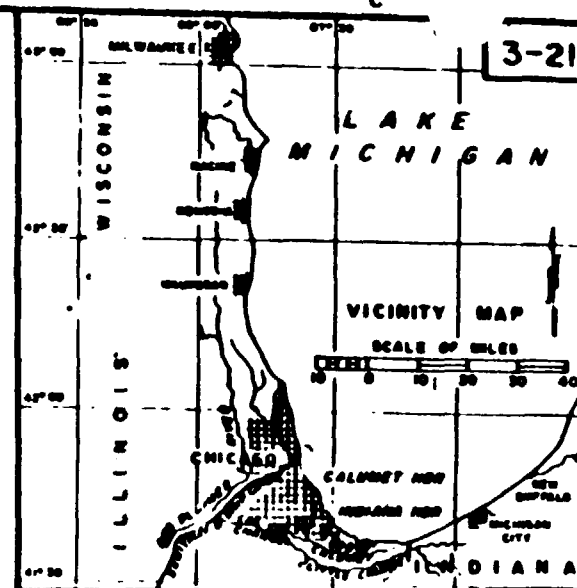
<u>PARAMETER</u>	<u>Non- Polluted</u>	<u>Moderately Polluted</u>	<u>Heavily Polluted</u>
Volatile Solids	19		
Chemical Oxygen Demand	19		
Oil and Grease	19		
Ammonia-Nitrogen	17	1	1
Total Kjeldahl Nitrogen	18	1	
Phosphorous	19		
Cyanide	13	2	1
Arsenic	4	10	5
Barium	15	4	
Cadmium	*	*	
Chromium	18		1
Copper	9	5	5
Iron	19		
Lead	18		1
Manganese	16	3	
Mercury	*	*	
Nickel	19		
Zinc	16	2	1

\*lower limits not established

Table B-2 Summary of pollution classification  
of sediment samples from Area 2.

<u>PARAMETER</u>	<u>Non- Polluted</u>	<u>Moderately Polluted</u>	<u>Heavily Polluted</u>
Volatile Solids	6	3	5
Chemical Oxygen Demand	7	3	
Oil and Grease	8	2	
Ammonia-Nitrogen	6	4	
Total Kjeldahl Nitrogen	6	4	
Phosphorous	10		
Cyanide	6	3	1
Arsenic		4	11
Barium	3	8	4
Cadmium	*	*	1
Chromium	9	5	1
Copper	2	3	5
Iron	10		
Lead	5	2	8
Manganese	3	6	1
Mercury	*	*	
Nickel	10		
Zinc	3	5	2

\*lower limits not established



PROJECT DEPTHS AND SOUNDINGS  
ARE REFERRED TO LOW WATER DATUM  
376.0 FEET ABOVE MEAN WATER LEVEL  
AT FATHER POINT, QUEBEC 16 L D (1955)  
(INTERNATIONAL GREAT LAKES DATUM)

 - Federal Navigation Channel

**Plate B-1**

**WAUKEGAN HARBOR,  
ILLINOIS**

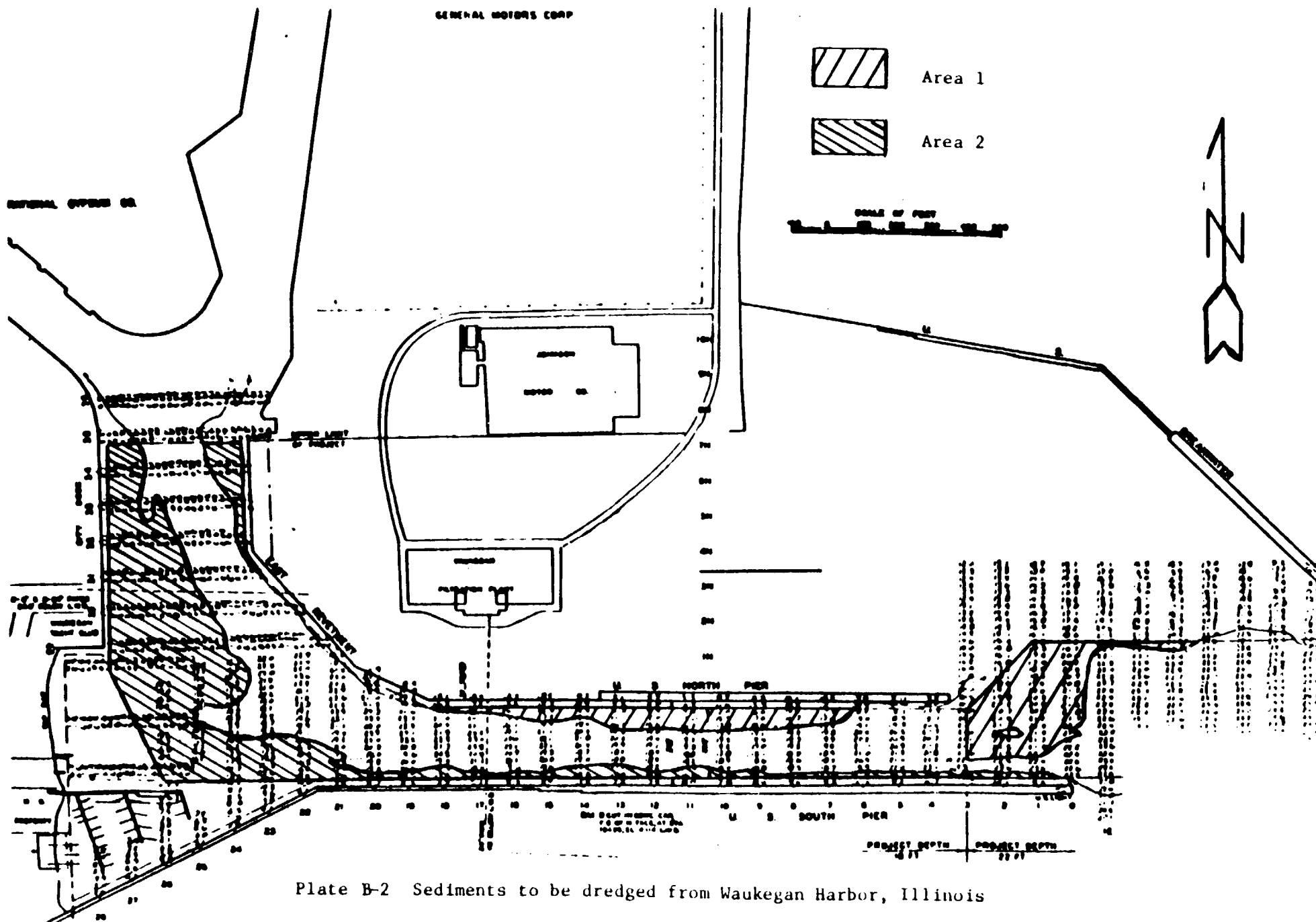
ON 3 SHEETS

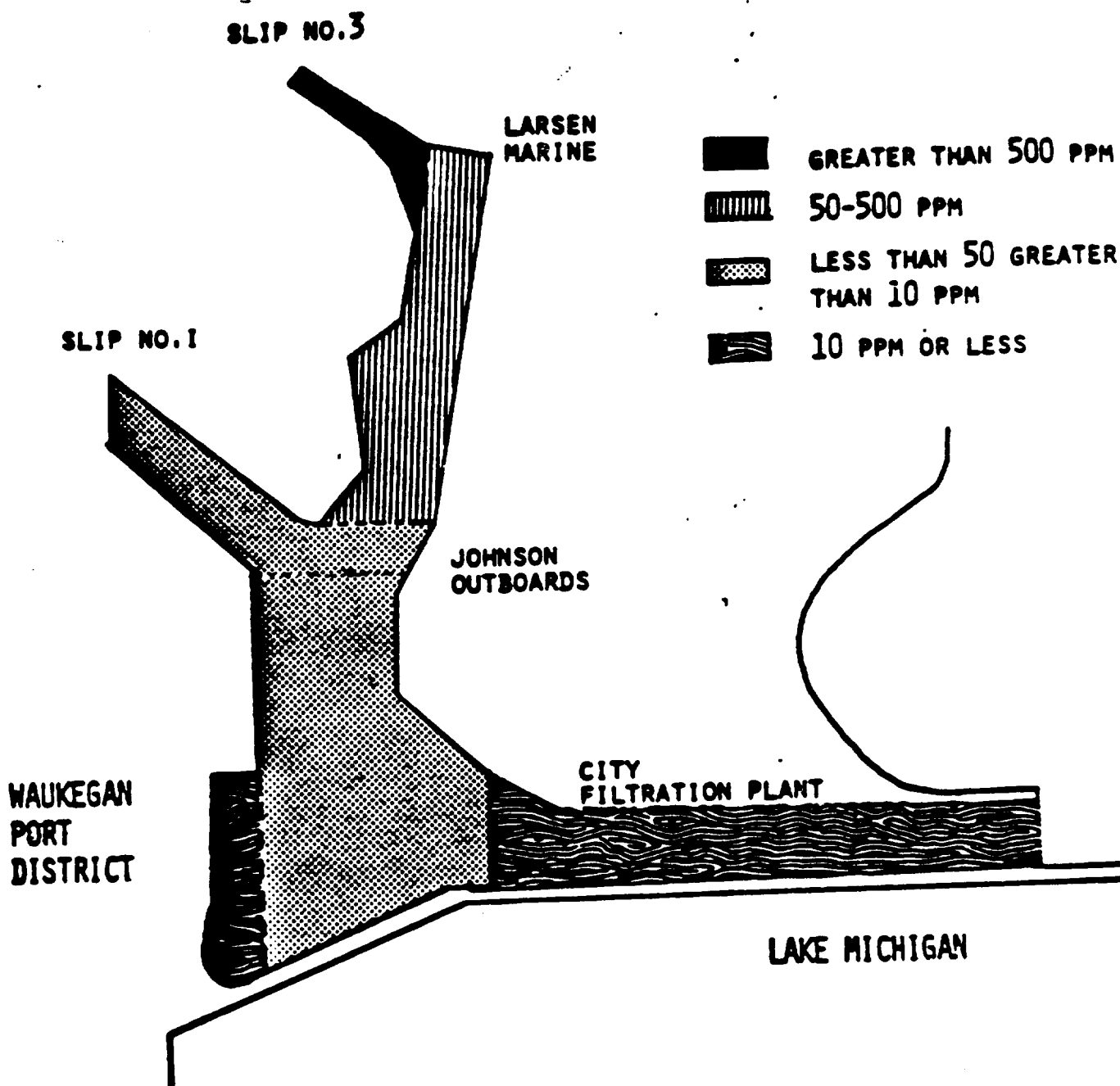
**SHEET NO 1**

SCALE OF FEET

CORPS OF ENGINEERS

CHICAGO 114





SCALE: 1"=500' (APPROXIMATE)

PLATE B-3 DISTRIBUTION OF PCB CONTAMINATION IN  
WAUKEGAN HARBOR SEDIMENT

(from US EPA report "The PCB Contamination Problem  
in Waukegan, Illinois", January 1981)

ATTACHMENT B-1

Results of Bulk Chemical and Standard Elutriate  
Analysis of Sediment Samples Collected from  
Waukegan Harbor in October 1981  
(from reference 5.3)

Table 1    Waukegan Grab Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>3</sup> (ft)	Moisture (%)	Volatile Solids (%)	COD	TKN	Ammonia Nitrogen	Total P	Nitrite Nitrate	Oil & Grease
CWH-06-81	Grab	-5 LWD	4.8	.309	1050	L 25	L 25	7	164	160
CWH-07-81	Grab	-16 LWD	39.9	.307	25700	1169	63	42	L 25	890
CWH-20-81	Grab	-14 LWD	60.7	6.730	41500	1871	131	88	L 25	1020
CWH-21-81	Grab	-23 LWD	50.2	6.030	44600	1655	206	51	L 25	880
CWH-22-81	Grab	-15 LWD	47.7	5.020	43200	1490	76	81	L 25	1180
Heavily polluted <sup>2</sup>				> 8	> 80000	> 2000	> 200	> 650		> 2000
Moderately polluted <sup>2</sup>				5-8	40000-80000	1000-2000	75-200	420-650		1000-2000
Non-polluted <sup>2</sup>				< 5	< 40000	< 1000	< 75	< 420		< 1000

1. All units expressed as mg/kg dry weight unless noted otherwise.

2. According to USEPA Region V Guidelines for Pollutonal Classification of Great Lakes Harbor Sediments

3. Depth is relative to International Great Lakes Low Water Datum (LWD).

**Table 2    Waukegan Grab Sample Bulk Chemistry Results<sup>1</sup>**

STATION ID	SAMPLE ID	DEPTH <sup>4</sup> (ft)	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Cu	Cn	Fe
CWH-06-81	Grab	-5 LWD	1250	L 50	2	L 5	L 5	L 5	16300	L 5	L 5	L 0.1	2180
CWH-07-81	Grab	-16 LWD	5759	L 50	11	27	L 5	L 5	45100	11	39	0.2	9260
CWH-20-81	Grab	-14 LWD	17237	80	43	48	L 5	6	41500	65	80	0.25	14420
CWH-21-81	Grab	-23 LWD	7048	L 50	14	43	L 5	L 5	50000	14	61	0.2	9730
CWH-22-81	Grab	-15	10813	L 50	22	65	L 5	L 5	39600	16	60	0.55	9470
Heavily polluted <sup>2</sup>					>8	>60		>6 <sup>3</sup>		>75	>50	>.25	>25000
Moderately polluted <sup>2</sup>					3-8	20-60				25-75	25-50	.1-.25	12000
Non-polluted <sup>2</sup>					<3	<20				<25	<25	<.1	<17000

1. All units expressed as mg/kg dry weight unless noted otherwise.
2. According to USEPA Region V Guidelines for Pollutional Classification Of Great Lakes Harbor Sediments
3. No acceptable concentrations established.
4. Depth is relative to International Great Lakes Low Water Datum ( IGLWD ).

Table 3 Waukegan Grab Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>4</sup> (ft)	Pb	Mg	Mn	Hg	Ni	K	Se	Na	Tl	Zn
CWH-06-81	Grab	-5 LWD	L 5	8400	80	L .1	L 5	50	18	100	L 100	L 50
CWH-07-81	Grab	-16 LWD	54	24700	352	L .1	7	900	40	200	290	169
CWH-20-81	Grab	-14 LWD	123	24400	450	L .1	13	2300	56	300	320	221
CWH-21-81	Grab	-23 LWD	49	27300	390	L .1	10	1400	42	300	300	136
CWH-22-81	Grab	-15 LWD	104	22200	317	L .1	9	800	41	200	270	161
Heavily polluted <sup>2</sup>			> 60		> 500	≥ 1 <sup>3</sup>	> 50					> 200
Moderately polluted <sup>2</sup>			40-60		300-500		20-50					90-200
Non-polluted <sup>2</sup>			< 40		< 300		< 20					< 90

1. All units expressed as mg/kg dry weight unless noted otherwise.
2. According to USEPA Region V Guidelines for Pollutational Classification of Great Lakes Harbor Sediments
3. No acceptable concentrations are established.
4. Depth is relative to International Great Lakes Low Water Datum (LWD).

**Table 4    Waukegan Grab Sample Bulk Chemistry Results<sup>1</sup>**

[illegible]

1. All units expressed as  $\mu\text{g/kg}$  dry weight (ppb).
2. Depth is relative to International Great Lakes Low Water Datum (LWL).

Table 5 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>3</sup> (ft)	Moisture (%)	Volatile Solids (%)	COD	TKN	Ammonia Nitrogen	Total P	Nitrite Nitrate	Oil & Grease
CWH-01-81	01	-19.5 to -21.5	20.3	1.280	5560	71	L 25	15	L 25	310
	02	-21.5 to -23.5	24.2	1.680	28000	584	100	31	L 25	520
	03	-23.5 to -25.5	19.6	1.070	10100	111	39	14	63	160
CWH-02-81	01	-21 to -23	20.2	0.978	6200	181	L 25	16	L 25	590
	02	-23 to -25	42.7	3.550	35200	1424	228	81	L 25	550
CWH-03-81	01	-20.2 to -22.2	19.4	3.750	24400	153	L 25	24	L 25	60
CWH-04-81	01	-18.5 to -20.5	16.5	0.720	6080	238	L 25	23	L 25	40
	02	-18.5 to -20.5	31.4	2.780	6980	187	L 25	28	L 25	210
	03	-20.5 to -22.5	18.5	0.981	8660	158	L 25	17	L 25	20
CWH-05-81	01	-16.7 to -18.7	33.1		35800	909	104	52	L 25	930
	02	-18.7 to -20.7	21.8	0.453	3450	68	L 25	11	L 25	70
	03	-20.7 to -22.7	18.7	0.801	22900	73	29	11	L 25	20
Heavily polluted <sup>2</sup>				> 8	> 80000	> 2000	> 200	> 650		> 2000
Moderately polluted <sup>2</sup>				5-8	40000-80000	1000-2000	75-200	420-650		1000-2000
Non-polluted <sup>2</sup>				< 5	< 40000	< 1000	< 75	< 420		< 1000

1. All units expressed as mg/kg dry weight unless noted otherwise.

2. According to USEPA Region V Guidelines for Pollutational Classification of Great Lakes Harbor Sediments

3. Depths reported relative to International Great Lakes Low Water Datum.

Table 6 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>4</sup> (ft)	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Cu	Cn	Fe
CWH-01-81	01	-19.5 to -21.5	1988	L 50	4	7	L 5	L 5	41900	L 5	7	L 0.1	4110
	02	-21.5 to -23.5	4464	L 50	9	20	L 5	L 5	76700	11	59	L 0.1	9570 <sup>1</sup>
	03	-23.5 to -25.5	3042	L 50	4	16	L 5	L 5	36500	7	39	L 0.1	7310
CWH-02-81	01	-21 to -23	1602	L 50	3	L 5	L 5	L 5	20300	L 5	30	L 0.1	3500
	02	-23 to -25	6955	L 50	13	39	L 5	L 5	56300	103	74	0.35	12740
CWH-03-81	01	-20.2 to -22.2	2052	L 50	3	21	L 5	L 5	32300	6	25	L 0.1	4360
CWH-04-81	01	-16.5 to -18.5	2161	L 50	6	6	L 5	L 5	23000	L 5	6	L 0.1	4090
	02	-18.5 to -20.5	3945	L 50	5	21	L 5	L 5	47600	8	95	L 0.1	9120
	03	-20.5 to -22.5	1962	L 50	4	6	L 5	L 5	50400	7	32	L 0.1	4420
CWH-05-81	01	-16.7 to -18.7	5174	L 50	12	34	L 5	L 5	44100	14	61	L 0.1	11520
	02	-18.7 to -20.7	2725	L 50	5	8	L 5	L 5	60900	L 5	L 5	L 0.1	4690
	03	-20.7 to -22.7	2131	L 50	4	6	L 5	L 5	49800	L 5	L 5	L 0.1	3560
Heavily polluted <sup>2</sup>					>8	>60		>6 <sup>3</sup>		>75	>50	>.25	>25000
Moderately polluted <sup>2</sup>					3-8	20-60				25-75	25-50	.1-.25	12000-25000
Non-polluted <sup>2</sup>					<3	<20				<25	<25	<.1	<17000

1. All units expressed as mg/kg dry weight unless noted otherwise.

2. According to USEPA Region V Guidelines for Pollutional Classification Of Great Lakes Harbor Sediments

3. No acceptable concentrations are established.

4. Depths reported relative to International Great Lakes Low Water Datum

Table 7 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH 4 (ft)	Pb	Mg	Mn	Hg	Ni	K	Se	Na	Tl	Zn
CWH-01-81	01	-19.5 to -21.5	18	21000	169	L 0.1	L 5	300	36	200	200	L 50
	02	-21.5 to -23.5	31	39900	474	L 0.1	6	700	45	300	360	90
	03	-23.5 to -25.5	16	15400	175	L 0.1	L 5	400	29	200	200	76
CWH-02-81	01	-21 to -23	30	10100	99	L 0.1	L 5	300	26	50	130	L 50
	02	-23 to -25	69	28400	383	L 0.1	10	1300	45	200	320	220
CWH-03-81	01	-20.2 to -22.2	19	15900	142	L 0.1	L 5	300	28	100	170	87
CWH-04-81	01	-18.5 to -20.5	7	12100	115	L 0.1	L 5	200	42	200	150	L 50
	02	-20.5 to -22.5	22	24400	298	L 0.1	L 5	400	27	200	280	171
	03	-22.5 to -24.5	20	27100	177	L 0.1	L 5	100	20	200	240	L 50
CWH-05-81	01	-16.7 to -18.7	141	23000	322	L 0.1	8	800	31	200	290	284
	02	-18.7 to -20.7	8	31400	207	L 0.1	L 5	300	43	300	260	L 50
	03	-20.7 to -22.7	L 5	25000	177	L 0.1	L 5	200	39	200	220	L 50
Heavily polluted <sup>2</sup>			> 60		> 500	≥ 1 <sup>3</sup>	> 50					> 200
Moderately polluted <sup>2</sup>			40-60		300-500		20-50					90-200
Non-polluted <sup>2</sup>			< 40		< 300		< 20					< 90

1. All units expressed as mg/kg dry weight unless noted otherwise.

2. According to USEPA Region V Guidelines for Pollutational Classification of Great Lakes Harbor Sediments

3. No acceptable concentrations are established.

Table 8 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>3</sup> (ft)	PCB's (total)	Archlor <sup>2</sup>							
				1016	1221	1232	1242	1248	1254	1260	1262
CWH-01-81	01	-19.5 to -21.5					8				L 1
	02	-21.5 to -23.5					7				L 1
	03	-23.5 to -25.5					L 1				6
CWH-02-81	01	-21 to -23					L 1				4
	02	-23 to -25					L 1				42
CWH-03-81	01	-20.2 to -22.2					L 1				12
CWH-04-81	01	-16.5 to -18.5					L 1				48
	02	-18.5 to -20.5					L 1				56
	03	-20.5 to -22.5					L 1				30
CWH-05-81	01	-16.7 to -18.7					L 1				1041
	02	-18.7 to -20.7					L 1				190
	03	-20.7 to -22.7					L 1				45

1. All units expressed as µg/kg dry weight (ppb).

2. Detectable levels ( > 1 ppb) of Archlors 1242 and 1262 only, all other Archlors are less than 1 ppb.

3. Depths reported relative to International Great Lakes Low Water Datum.

Table 9 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>3</sup> (ft)	Moisture (%)	Volatile Solids (%)	COD	TKN	Ammonia Nitrogen	Total P	Nitrite Nitrate	Oil & Grease
CWH-06-81	01	-5.1 to -7.6	21.8	0.331	1880	L 25	L 25	8	L 25	70
	02	-7.6 to -10.1	19.9	0.338	2420	L 25	L 25	9	L 25	40 <sup>1</sup>
	03	-10.3 to -13.3	16.3		2620	L 25	L 25	11	L 25	40
	04	-13.3 to -15.3	19.7	0.601	4000	37	L 25	13	L 25	120
	05	-15.3 to -17.3	16.5	0.551	4260	L 25	L 25	13	L 25	140
	06	-17.3 to -19.3	12.2	1.280	13300	97	L 25	12	L 25	330
	07	-19.3 to -21.3	11.4	1.250	23400	206	L 25	16	L 25	40
CWH-07-81	01	-16.8 to -19.8	9.7	2.160	29800	282	L 25	24	L 25	310
	02	-19.8 to -21.3	27.6	2.040	21100	423	62	29	L 25	420
	03	-21.3 to -22.8								
CWH-08-81	01	-15.8 to -18.3	19.6	0.843	5810	L 25	L 25	10	L 25	290
	02	-18.3 to -20.3	16.5	1.060	18200	28	L 25	9	L 25	660
	03	-20.3 to -22.8	18.0	1.380	7650	244	L 25	28	L 25	420
Heavily polluted <sup>2</sup>				> 8	> 80000	> 2000	> 200	> 650		> 2000
Moderately polluted <sup>2</sup>				5-8	40000-80000	1000-2000	75-200	420-650		1000-2000
Non-polluted <sup>2</sup>				< 5	< 40000	< 1000	< 75	< 420		< 1000

1. All units expressed as mg/kg dry weight unless noted otherwise.

2. According to USEPA Region V Guidelines for Pollutational Classification of Great Lakes Harbor Sediments

3. Depths reported relative to International Great Lakes Low Water Datum.

Table 10 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>4</sup> (ft)	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Cu	Cn	Fe
CWH-06-81	01	-5.1 to -7.6	1251	L 50	L 1	L 5	L 5	L 5	15500	L 5	L 5	L 0.1	2360
	02	-7.6 to -10.1	1800	L 50	L 1	L 5	L 5	L 5	17300	L 5	L 5	0.2	3660
	03	-10.1 to -13.3	2657	L 50	7	13	L 5	L 5	21600	L 5	L 5	L 0.1	6220
	04	-13.3 to -15.3	1423	L 50	4	L 5	L 5	L 5	24600	L 5	118	L 0.1	3760
	05	-15.3 to -17.3	2376	L 50	7	7	L 5	L 5	26800	L 5	8	L 0.1	6050
	06	-17.3 to -19.3	3750	L 50	10	13	L 5	L 5	22800	L 5	34	0.2	8750
	07	-19.3 to -21.3	8233	L 50	19	25	L 5	L 5	59900	L 5	37	L 0.1	15500
CWH-07-81	01	-16.8 to -19.8	10608	60	17	34	L 5	L 5	58900	L 5	37	L 0.1	15660
	02	-19.8 to -21.3	3377	L 50	8	18	L 5	L 5	54700	L 5	63	L 0.1	9290
	03	-21.3 to -22.8											
CWH-08-81	01	-15.8 to -18.3	1901	L 50	4	7	L 5	L 5	27200	L 5	L 5		4340
	02	-18.3 to -20.3	1018	L 50	L 1	L 5	L 5	L 5	13100	L 5	15		2040
	03	-20.3 to -22.8	2748	L 50	15	7	L 5	L 5	25000	L 5	51		3930
Heavily polluted <sup>2</sup>					>8	>60		>6 <sup>3</sup>		>75	>50	>.25	>25000
Moderately polluted <sup>2</sup>					3-8	20-60				25-75	25-50	.1-.25	12000-25000
Non-polluted <sup>2</sup>					<3	<20				<25	<25	<.1	<17000

1. All units expressed as mg/kg dry weight unless noted otherwise.
2. According to USEPA Region V Guidelines for Pollutonal Classification Of Great Lakes Harbor Sediments
3. No acceptable concentrations are established.
4. Depths reported relative to International Great Lakes Low Water Datum.

Table 11 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH (ft) <sup>4</sup>	Pb	Mg	Mn	Hg	Ni	K	Se	Na	Tl	Zn
CWH-06-81	01	-5.1 to -7.6	L 5	7600	75	L 0.1	L 5	50	9	50	L 100	L 50
	02	-7.6 to -10.1	L 5	8800	114	L 0.1	L 5	50	13	100	130	L 50
	03	-10.1 to -13.3	8	10800	198	L 0.1	L 5	200	6	200	160	L 50
	04	-13.3 to -15.3	7	12600	112	L 0.1	L 5	50	10	200	150	86
	05	-15.3 to -17.3	L 5	14200	166	L 0.1	L 5	100	8	100	170	L 50
	06	-17.3 to -19.3	L 5	12300	239	L 0.1	L 5	700	9	200	190	L 50
	07	-19.3 to -21.3	L 5	34500	554	L 0.1	L 5	1600	14	300	370	68
CWH-07-81	01	-16.8 to -19.8	L 5	33400	545	L 0.1	L 5	2900	15	300	390	157
	02	-19.8 to -21.3	11	28800	307	L 0.1	L 5	500	14	200	290	118
	03	-21.3 to -22.8										
CWH-08-81	01	-15.8 to -18.3	L 5	13800	137	L 0.1	L 5	200	7	300	160	L 50
	02	-18.3 to -20.3	L 5	6600	62	L 0.1	L 5	50	7	50	L 100	L 50
	03	-20.3 to -22.8	11	12400	119	L 0.1	L 5	50	11	100	150	L 50
Heavily polluted <sup>2</sup>			> 60		> 500	≥ 1 <sup>3</sup>	> 50					> 200
Moderately polluted <sup>2</sup>			40-60		300-500		20-50					90-200
Non-polluted <sup>2</sup>			< 40		< 300		< 20					< 90

1. All units expressed as mg/kg dry weight unless noted otherwise.
2. According to USEPA Region V Guidlines for Pollutonal Classification of Great Lakes Harbor Sediments
3. No acceptable concentrations are established.
4. Depths reported relative to International Great Lakes Low Water Datum.

Table 12 Waukegan Core Sample Bulk Chemistry Results<sup>1</sup>

STATION ID	SAMPLE ID	DEPTH <sup>3</sup> (ft)	PCB's (total)	Archlor <sup>2</sup>							
				1016	1221	1232	1242	1248	1254	1260	1262
CWH-06-81	01	-5.1 to -7.6					L 1				27
	02	-7.6 to -10.1					L 1				55 <sup>1</sup>
	03	-10.1 to -13.3					L 1				67
	04	-13.3 to -15.3					L 1				278
	05	-15.3 to -17.3					L 1				26
	06	-17.3 to -19.3					L 1				19
	07	-19.3 to -21.3					L				56
CWH-07-81	01	-16.8 to -19.8					L 1				33
	02	-19.8 to -21.3					L 1				17
	03	-21.3 to -22.8					L 1				
CWH-08-81	01	-15.8 to -18.3					L 1				7
	02	-18.3 to -20.3					38				133
	03	-20.3 to -22.8					L 1				14

1. All units expressed as µg/kg dry weight (ppb).

2. Detectable levels ( > 1 ppb) of Archlors 1242 and 1262 only, all other Archlors are less than 1 ppb.

3. Depths reported relative to International Great Lakes Low Water Datum.

Table 13 Results of Elutriate Analysis<sup>1</sup>

STATION ID	SUB-Samples <sup>2</sup>	TYPE <sup>3</sup>	Diss. Solids mg/l	TKN mg/l	NH <sub>3</sub> -N mg/l	Diss. P	NO <sub>2</sub> & NO <sub>3</sub> mg/l	Al	Sb	As	Ba	Be	Cd	Ca mg/l	Cr
CWH-1-81	3	Elut	168	4.3	4.3	L 10	0.1	70	L 100	L 1	39	L 1	L 1	63	L 1
		H <sub>2</sub> O	16	0.2	L 0.1	L 10	0.3	L 50	L 100	L 1	14	L 1	L 1	47	L 1
CWH-2-81	2	Elut	160	5.4	5.4	L 10	0.1	420	L 100	5	35	L 1	L 1	49	3
		H <sub>2</sub> O	148	0.2	L 0.1	L 10	0.3	L 50	L 100	L 1	14	L 1	L 1	48	L 1
CWH-3-81	1	Elut	300	2.2	2.2	L 10	0.1	100	L 100	L 1	37	L 1	L 1	73	L 1
		H <sub>2</sub> O	18	0.2	L 0.1	30	0.3	L 50	L 100	2	15	L 1	L 1	47	L 1
CWH-4-81	3	Elut	174	1.5	1.5	L 10	0.1	130	L 100	L 1	36	L 1	L 1	66	L 1
		H <sub>2</sub> O	172	0.2	L 0.1	L 10	0.3	L 50	L 100	L 1	14	L 1	L 1	47	L 1
CWH-5-81	3	Elut		1.6	1.2	L 10	8.3	90	L 100	13	35	2	L 1	87	2
		H <sub>2</sub> O		0.3	L 0.1	10	0.3	L 50	L 100	2	14	L 1	L 1	48	L 1
CWH-6-81	7	Elut	186	0.8	0.8	L 10	0.3	180	L 100	L 1	43	L 1	L 1	66	L 1
		H <sub>2</sub> O	184	0.2	0.1	L 10	0.3	L 50	L 100	L 1	14	L 1	L 1	48	L 1
Illinois Standards for Lake Michigan water <sup>4</sup>			≤ 180		≤ 0.02					≤ 10	≤ 1000		≤ 100		≤ 50

1. All units expressed as µg/l unless noted otherwise.

2. Sub samples from a boring station were combined and an elutriate prepared with this composite.

3. Analysis was performed on the elutriate and the background water used in the preparation.

4. According to Illinois PCB (reference 1.6.g).

Table 14 Results of Elutriate Analysis<sup>1</sup>

STATION ID	SUB <sup>2</sup> SAMPLES	TYPE <sup>3</sup>	Cu	Cd	Fe	Pb	Mg mg/l	Mn	Hg	Ni	K mg/l	Se	Na mg/l	Tl	Zn
CWH-1-81	3	Elut	L 5	L 0.1	L 100	5	13	20	1.1	L 5	L 1	L 1	6	100	50
		H <sub>2</sub> O	13		L 100	4	12	L 10	L 1	L 5	L 1	L 1	5	100	L 50
CWH-2-81	2	Elut	6	L 0.1	400	4	14	30	1.3	L 5	4	L 1	6	200	L 50
		H <sub>2</sub> O	L 5		L 100	L 2	12	L 10	L 1	L 5	L 1	L 1	5	100	L 50
CWH-3-81	1	Elut	L 5	L 0.1	L 100	L 2	12	L 10	L 1	L 5	3	L 1	6	200	L 50
		H <sub>2</sub> O	7		L 100	8	12	L 10	L 1	L 5	L 1	L 1	6	100	L 50
CWH-4-81	3	Elut	L 5	L 0.1	L 100	L 2	14	20	L 1	L 5	3	L 1	6	200	L 50
		H <sub>2</sub> O	9		L 100	L 2	12	L 10	L 1	L 5	L 1	L 1	6	L 100	L 50
CWH-5-81	3	Elut	6		L 100	L 2	19	80		L 5	L 1	6	7	400	L 50
		H <sub>2</sub> O	7		L 100	3	12	L 10	1.1	L 5	L 1	L 1	6	200	L 50
CWH-6-81	7	Elut	L 5	L 0.1	L 100	L 2	14	L 10	1.3	6	3	L 1	8	200	L 50
		H <sub>2</sub> O	10		L 100	5	12	L 10	L 1	L 5	L 1	L 1	6	L 100	L 50
Illinois Standards for Lake Michigan water <sup>4</sup>			≤ 20	≤ 25	≤ 300	≤ 50		≤ 50	≤ 0.5	≤ 1000		≤ 100			≤ 1000

1. All units expressed as µg/l unless noted otherwise.

2. Sub samples from a boring station were combined and an elutriate prepared with this composite.

3. Analysis was performed on the elutriate and the background water used in the preparation.

4. According to Illinois PCB (reference 1.6.g).

**Table 15 Results of Elutriate Analysis** <sup>1</sup>

[illegible]

1. All units expressed as  $\mu\text{g/l}$  unless noted otherwise.
2. Sub samples from a boring station were combined and an elutriate prepared with this composite.
3. Analysis was performed on the elutriate and the background water used in the preparation.
4. According to Illinois PCB (reference 1.6.g).

Table 16 Results of Elutriate Analysis<sup>1</sup>

STATION ID	SUB <sup>2</sup> SAMPLES	TYPE <sup>3</sup>	Cu	Cd	Fe	Pb	Mg mg/l	Mn	Hg	Ni	K mg/l	Se	Na mg/l	Tl	Zn
CWH-7-81	2	Elut	L 5	L 0.1	L 100	L 2	16	20	L 1	L 5	5	L 1	8	300	L 50
		H <sub>2</sub> O	L 5		L 100	L 2	12	L 10	L 1	L 5	L 1	L 1	6	100	L 50
CWH-8-81	3	Elut	27		1200	13	11	10		L 5	L 1	5	6	400	L 50
		H <sub>2</sub> O	7		L 100	3	12	L 10	1.1	L 5	L 1	L 1	6	200	L 50
Illinois Standards for Lake Michigan water <sup>4</sup>			≤ 20	≤ 25	≤ 300	≤ 50		≤ 50	≤ 0.5	≤ 1000		≤ 100			≤ 1000

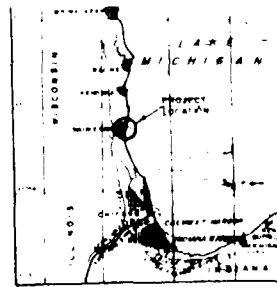
1. All units expressed as µg/l unless noted otherwise.

2. Sub samples from a boring station were combined and an elutriate prepared with this composite.

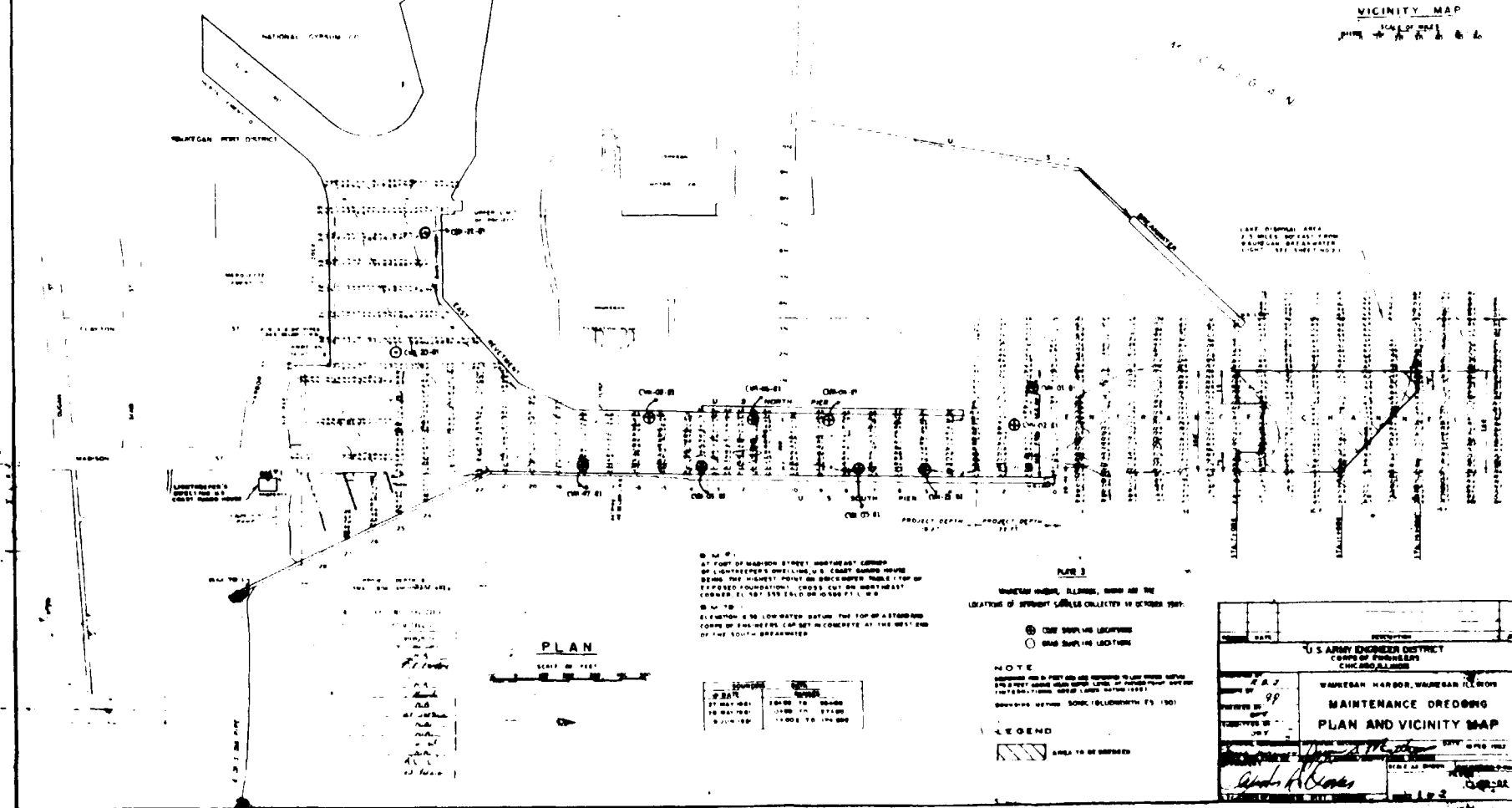
3. Analysis was performed on the elutriate and the background water used in the preparation.

4. According to Illinois PCB (reference 1.6.g).

# WAUKEGAN HARBOR-WAUKEGAN, ILLINOIS MAINTENANCE DREDGING



VICINITY MAP  
SCALE OF MILES  
0 5 10



U.S. ARMY ENGINEER DISTRICT CHICAGO, ILL.	
WAUKEGAN HARBOR, WAUKEGAN, ILL.	
MAINTENANCE DREDGING PLAN AND VICINITY MAP	
DATE 1951	BY [Signature]
APPROVED BY [Signature]	DATE 1951

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX C  
GEOLOGY AND SOILS

WAUKEGAN HARBOR CDF SITE SELECTION

An investigation of the three final CDF sites of the original sixteen proposed CDF sites was undertaken during the third and fourth weeks of June. These sites were selected by a process of elimination, with various sites being withdrawn for consideration due, chiefly to adverse opposition of land owners and the immediate community of each site area to a confined disposal facility to contain the dredged material in Waukegan Harbor. Due to extensive media coverage of the PCB problems in the Waukegan Harbor area, strong local opposition exists to CDF sites.

The three sites investigated have the least, or minimal opposition. Site 16 is located in the immediate harbor area and would be the most acceptable site from a public relations or ownership standpoint. Site 4 as it is located immediately adjacent to a similar existing landfill operation has less opposition for this reason than site 1 located on proposed airport extension land. The latter site in fact was not drilled as originally planned as the landowners would not give access to their property or permission to drill, and the holes drilled were relocated on county airport owned land immediately south of the proposed area.

The exploration borings were taken by a crew from the St. Paul District comprised of the following persons: Elmer Schmidtken, driller/foreman, George Lackey, oiler/helper, Mike McWilliams, driver/laborer. The drill was F-700 Ford truck mounted CME 55 drill rig, accompanied by a GMC supply truck (VE-600), a Dodge power wagon (Model 200) and a 500 gallon trailer mounted water tank.

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

The CME drill was equipped with an automatic drive hammer to obviate blow count errors, such as, too short strokes, fatigue and missed count. (The hammer had a counter to register accurate counts). This automatic hammer greatly facilitated and speeded up the accuracy and rate of sampling.

A continuous sampling procedure was followed in each hole with undisturbed samples taken <sup>EACH</sup> at change of material that could be sampled. Sampling commenced at site #4, moved to site #1 and ended on site #16, however, an additional boring hole was taken on site #1. A total of 201 disturbed and 23 undisturbed 3" Shelby tube samples were taken. The disturbed drive samples were standard penetration test (SPT) samples taken with a 140# hammer falling 30" and using a split spoon-2"O.D. or 1 1/2" I.D. with 3.0 feet internal length or 3 1/2 feet external length. Drives were made for two feet and were continuous except for the undisturbed samples. Undisturbed sampling was staggered from hole to hole to obtain a better soil profile. To obtain entry to the site 16 property owned by OMC it was necessary to promise that only engineering property tests would be taken, no chemical testing would be allowed and the samples taken would be destroyed after testing.

Physiography and Drainage - Lake County is in the Wheaton Morainal country of the Great Lakes section of the Central Lowland province. In general it has gently sloping relief and poorly defined drainage patterns. Many drainage ways terminate in marshes and depressions. The extreme eastern edge of the county for 2 to 3 miles inland drains into Lake Michigan and sites 1 and 16 drain back to Lake Michigan. Site 4 drains into the Des Plaines River. Wells supplying individual homes have been drilled into the glacial drift, but those supplying villages, towns and cities have been drilled into the underlying bedrock or have water supplies pumped in from Lake Michigan.

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

Geology - The site is located on the northern end of the Kankakee area, a broad gently sloping area of paleozoic sediments that connect the Wisconsin arch immediately to the northwest with the Cincinnati area to the southeast and thus separates the Michigan and Illinois basins.

Bedrock Geology - Buried bedrock valleys head near the crest of the Niagara Cuesta and flow eastward down dip or diverge slightly to the northeast in Illinois and Wisconsin. Of five important valleys in Illinois, two enter the lake in Lake County. These valleys are relatively broad and shallow with low gradients and pass below the present shore of Lake Michigan at elevations of around 450 feet M.S.L. The glacial drift in the valleys themselves may be Illinoian overlain by the younger Wisconsin Lake Moraine material. The Silurian bedrock strata underlying the till strike essentially North-South and have a regional eastward dip of about 15 feet per mile. The Silurian formations comprise a resistant dolomite unit of uniform composition with maximum thickness of about 450 feet in the Lake County area. The upper part of the system consists of Racine and Waukesha rocks with large erosion resistant reefs common. These reefs outcrop farther south and north and occur between the bedrock valleys. The buried Niagaran Cuesta reaches a maximum elevation of about 900 feet in Mc Henry County and drops about 450 feet over a 30 mile distance from there to the lake shoreline. Local buried relief is about 100 feet between the valley bottoms and rims so the glacial drift varies from 100' to 250' in thickness with Klintar rising to underground elevations 50' to 100' above general bedrock levels.

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

Geology - There are four broad low moraines along Lake Michigan in Lake County all composed of clayey till running roughly parallel to the Lake Shore. These morainal ridges have a very marked drainage control. The westernmost parallels the Des Plaines River and is called the Park Ridge. In northern Lake County it has fused with the next easterly moraine, the Deerfield, but further South they separate into distinct moraines. The Blodgett Moraine is the smallest and least distinct moraine, while the Highland Park Moraine runs immediately parallel to the lake and is characterized on its east side by wave cut bluffs. The glacial soils are geologically speaking of recent origin (less than 11,000 years old) and so are relatively unleached and calcareous. Sandy gravelly clay tills predominate in site areas No. 1 and No. 4 which are located on the Highland Park Moraine.

#### SITE LOCATIONS

	Township - Range -		Section	Roads
1	46N.	12.E.	29 SW 1/4 (Airport Ext.)	Oak Rd. - Wadsworth SE & Lewis Avenue
4.	46N.	12.E.	17 SW 1/4 - 18 NW 1/4	Greenbay Road - 9th St. & 17th St.
16.	45N.	12.E.	22 NW 1/4	Sea Horse Drive - South and West

#### INDIVIDUAL SITES

Waukegan Airport Area - Site 1,  
5318 - Markham Silt Loam - 1 to 4% slopes - 531 C - 4% - 7% slopes  
232 Ashkum Silty Clay Loam  
979 B - Grays and Markham Silt Loams  
194 - Morley Silt Loam - 4 to 7% slopes

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

These are gently sloping to steep well drained to moderately well drained deep soils with moderately slow permeability derived from glacial morainal clay till characterized by a sandy silty clay soil with small rounded pebble gravel. At the airport area site some dredgings could be spread between the existing and a proposed new runway in an elongated site between runways. Bedrock elevations would be at around 500' to 550' while airport runway elevations are 715 feet. So overburden depth in this area is about 200 feet.

Site 1 - This is a triangular area northeast of the airport which would be acquired by the airport under a proposed future runway extension. It is presently covered by brush, small trees and grass. The soil is weathered residual till soil or a silty clay with fine to coarse sand and rounded gravel pebbles. This is the most isolated and suitable site in the airport area.

Site 4. - Along Highway 131 (Green Bay Road) near the Wisconsin border Site 4 is east of the highway (about 310 acres) between Highway 173 (17th St. and 9th St.). The area consists of gently sloping to steeply sloping agricultural lands with well to moderately well drained deep soils and moderate to moderately slow permeability. Soil symbols are 27C, 57B, 298, 232, 298, 330, 443, 495, 979, 984 and 989; Miami Silt Loam, Montmorenci Silt Loam, Pella Silty Clay Loam, Beecher Silt Loam, Peotone Silty Clay Loam, Barrington Silt Loam, Corwin Silt Loam, Grays and Markham Silt Loams, Barrington and Varna Silt Loams and Mundelein Elliott Silt Loams. The soil appears to be derived from morainal silty clay till with sand and rounded pebbles or gravel. Elevations range from 700 to 730 ft. with bedrock around 500 feet or over 200 feet deep.

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

Site 16W - Located on property belonging to OMC between Sea Horse Drive and the inner harbor in an open field used for parking in the area of Waukegan Harbor which is located on Lake Michigan about 8 miles south of the Wisconsin-Illinois Line and about 25 miles north of Chicago. The Harbor is an artificial or man made one with a project depth of -18 LWD. The Harbor contains two marinas, a marine engineering service, a cement company and the large manufacturing complex of Outboard Marine Corporation. The predevelopment terrain consisted of coastal dunes with a marsh or swampy area underlying a bluff which represent a lake terrace or former shore line of ancient Lake Michigan.

Soils - The surface soils are aeolian dune sands generally very fine to fine grained overlying transgressing beach sands, fine to coarse grained. The dune sands are very loose to medium dense while the beach sand is loose to dense. These sands interfinger and overlay the Waukegan member of the Lake Michigan formation which forms or underlies much of the lake bottom by Waukegan and much of the center and eastern side of southern Lake Michigan. Some till and bedrock outcrops occur in local high areas and this formation is absent. It consists of soft sandy silt, varved with silty clay with a high sand, gravel and water content. The member becomes sandier shoreward and pinches out to a brown silt facies less than a foot thick under Waukegan proper. The sand above the Waukegan is often termed the Ravinia sand member and is usually clean unless contaminated by man. Below the Waukegan is the Lake Forest member, 0-4' feet thick with varved dark gray silty clay (winter) interspersed with organic black summer clay layers and from 6920 to 7050 years B.P. (before present) old  $\pm$  200 years as measured by radio<sup>active</sup> carbon content.

NCCPE-TS

SUBJECT: Waukegan Harbor CDF Site Selection

1-6 feet of brown gray clay with intervening black beds, seams or varves underlies the Lake Forest member. This clay is somewhat sandy and is termed the Winnetka member. In this area it rests on glacial till.

The glacial till is Woodfordian and is a sandy silty clay with gravel and high carbonate content. It has been formed by glacial action from underlying Silurian dolomites and Devonian shales.

Most previous soil borings have been done in the harbor or the harbor structures in this area. These were generally very shallow except for some off shore borings which indicated hard tills at -50 LWD elevations. The site 16W area found till at depths of -25 to -30 LWD a much more favorable disposal site condition.

#### Site Elevation

General - All sites are located in Lake County in the NE corner of Illinois in the vicinity of Waukegan. Site 1 is located on the Highland Park Moraine, site 4 on the lake border ground moraine and site 16 on a littoral drift or beach sand area.

All sites are underlain by impermeable clay till bottoms. In site 1 impermeable clay till lies at depths of 3' to 9'. In site 4 around 10 feet deep but vertical permeability exists and a bottom liner will be necessary. In site 16, the till layer lies at depth of between 25' and 30' with overlying permeable sands. See cross sections. The ground conditions are best at site 1 but site 16 is the most conveniently located. Site 1 will require no liner and its dikes can be built of clay material excavated in the dike area. Site 4 will require compaction and/or lining of its bottom while site 16 will need a clay bottom liner and dikes which must be transported into the site and this will offset the higher transportation costs for waste disposal at sites 1 and 16.

NCCPE-TS  
SUBJECT: Waukegan Harbor CDF Site Selection

The area around site 16W might be excavated as a new harbor slip while the old highly contaminated slip is encapsulated and used as a CDF area. In this regard the black organics(?) that occur in the sand must eventually be analyzed to see if the black material is harmless natural organics or injected industrial waste material in which case our waste disposal problem becomes far more complicated, serious and expensive if the waste was of a hazardous nature.

PERMEABILITY OF SITES

SITE	Recharge Tests			Test Depths				
	HOLES	W.T.@	Tests					
1W	1	-9.7	0	5 Min. Tests				
	4&5	Dry	0	18'-20'	13'-20'	8'-20'	3'-20'	K
	2	Dry below 12'	4	0	0	0	0	V. Low
	3		4	10 Min. Tests				
				20'-24'	15'-24'	10'-15'	5'-10'	
				12.5 gpm	No take *Cave in	1/10 gpm	1/10 gpm	

Horizontal permeability probably present along thin sand seams. Water penetrates soil along rotted tree roots and other deep rooted vegetation.

4W	1	27.0'	1	0-40'	0 gpm	Use of drilling mud prevented testing
	2	14.6'	0	0-40	z	
	3	10.7'	1	0-34	0 gpm	
16W	1	2.2	0	Use of drilling mud		
	2	1.8	0	Prevented testing		
	3	2.4	0			
	4	3.3	1	0-10' depth - 0.5 gpm water - 30 gallons per hour		
	5	4.0	0	8'-10' - 1 gpm - 60 gallons per hour		

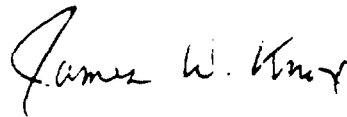
When drill water was used we had 100% drill water return indicating very low permeabilities. However areas of clean sand had very large water takes and required use of drilling mud.

NCCPE-TS

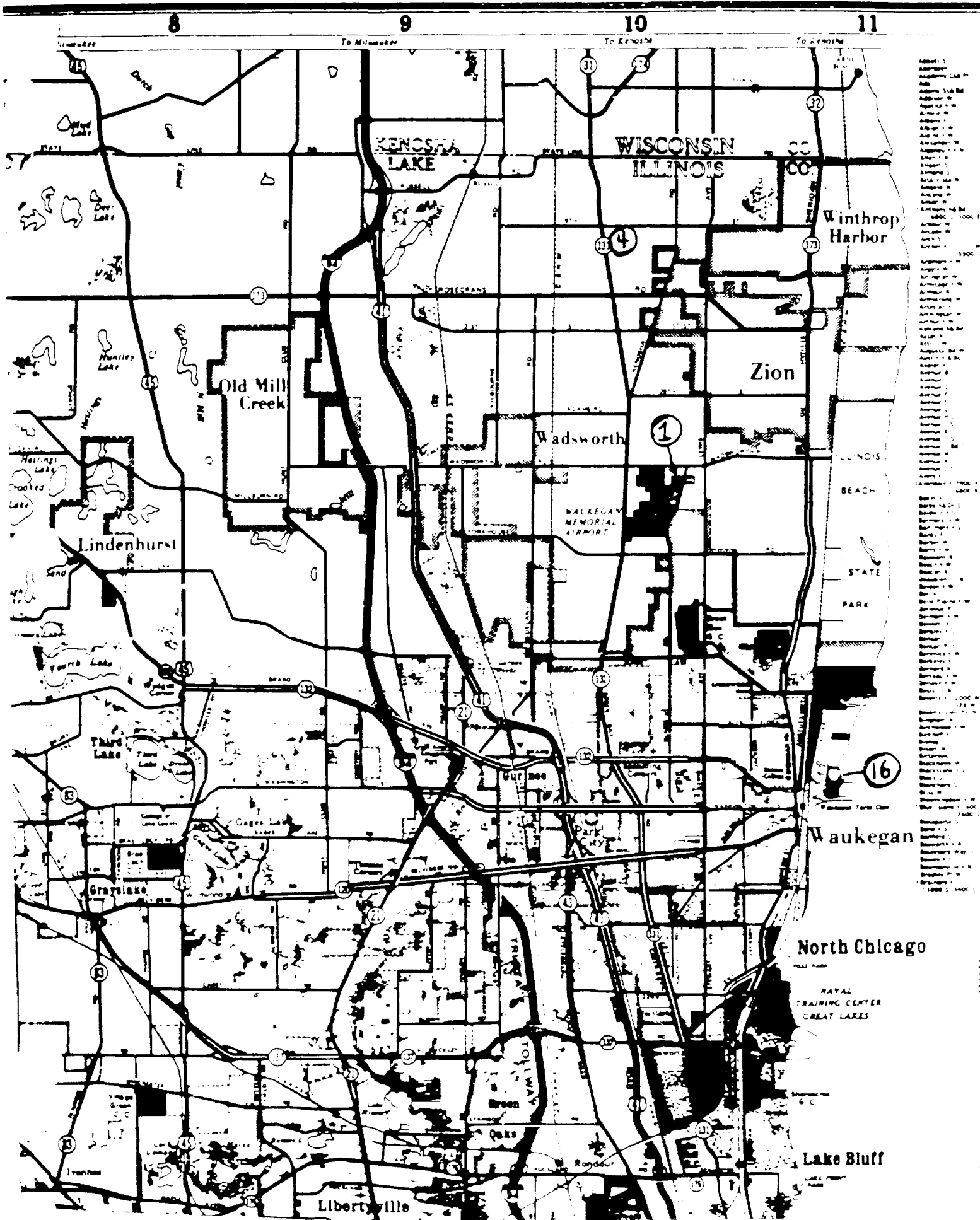
SUBJECT: Waukegan Harbor CDF Site Selection

SITE RECOMMENDATION

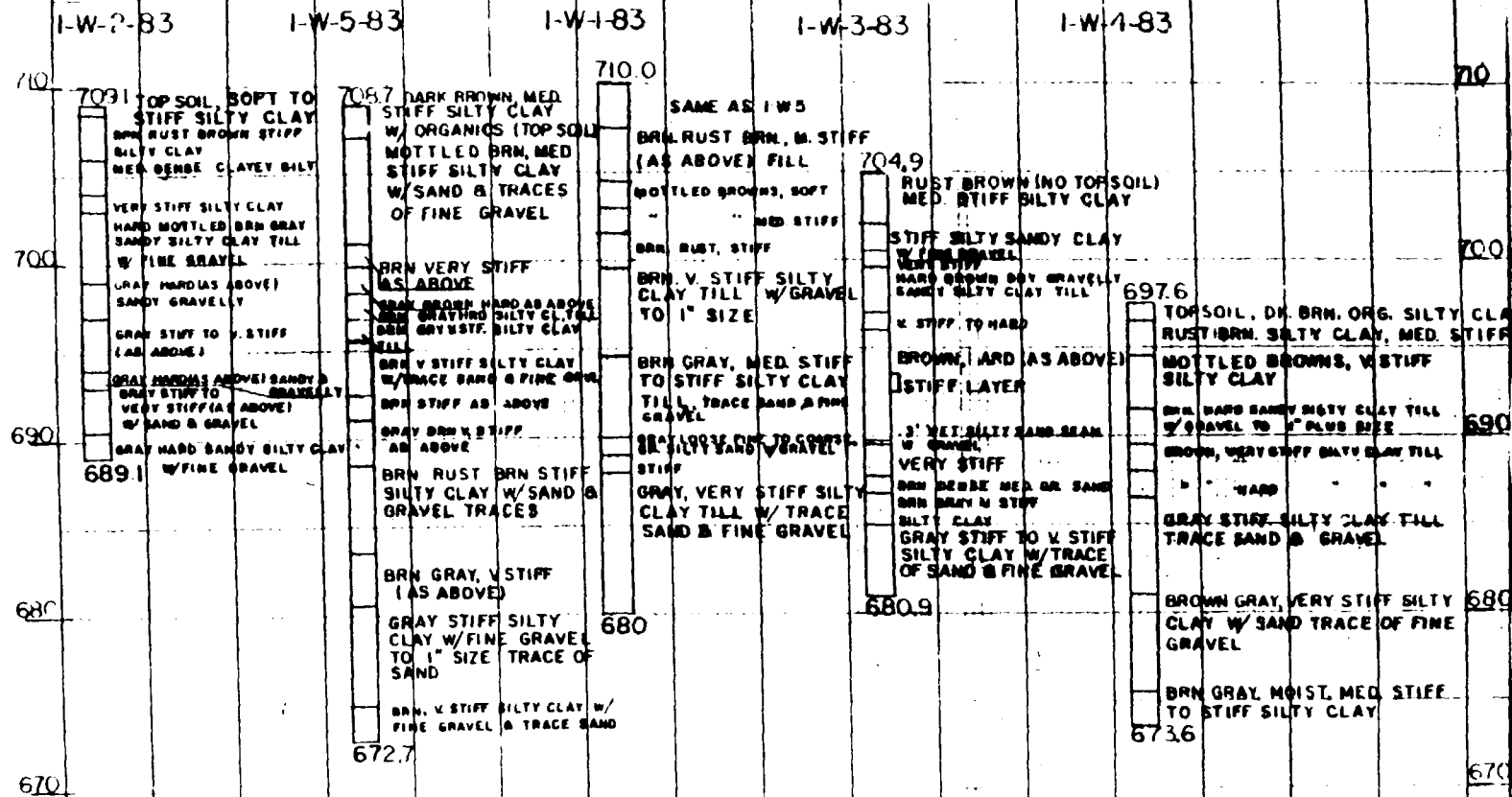
Site 1 is the preferred site as it is underlain by the most impermeable material at the shallowest depth and would be the most economical CDF site to construct.



JAMES W. KNOX  
District Geologist  
Chicago District



# MAUNEGAN HARBOR SITE SELECTION - SITE 1



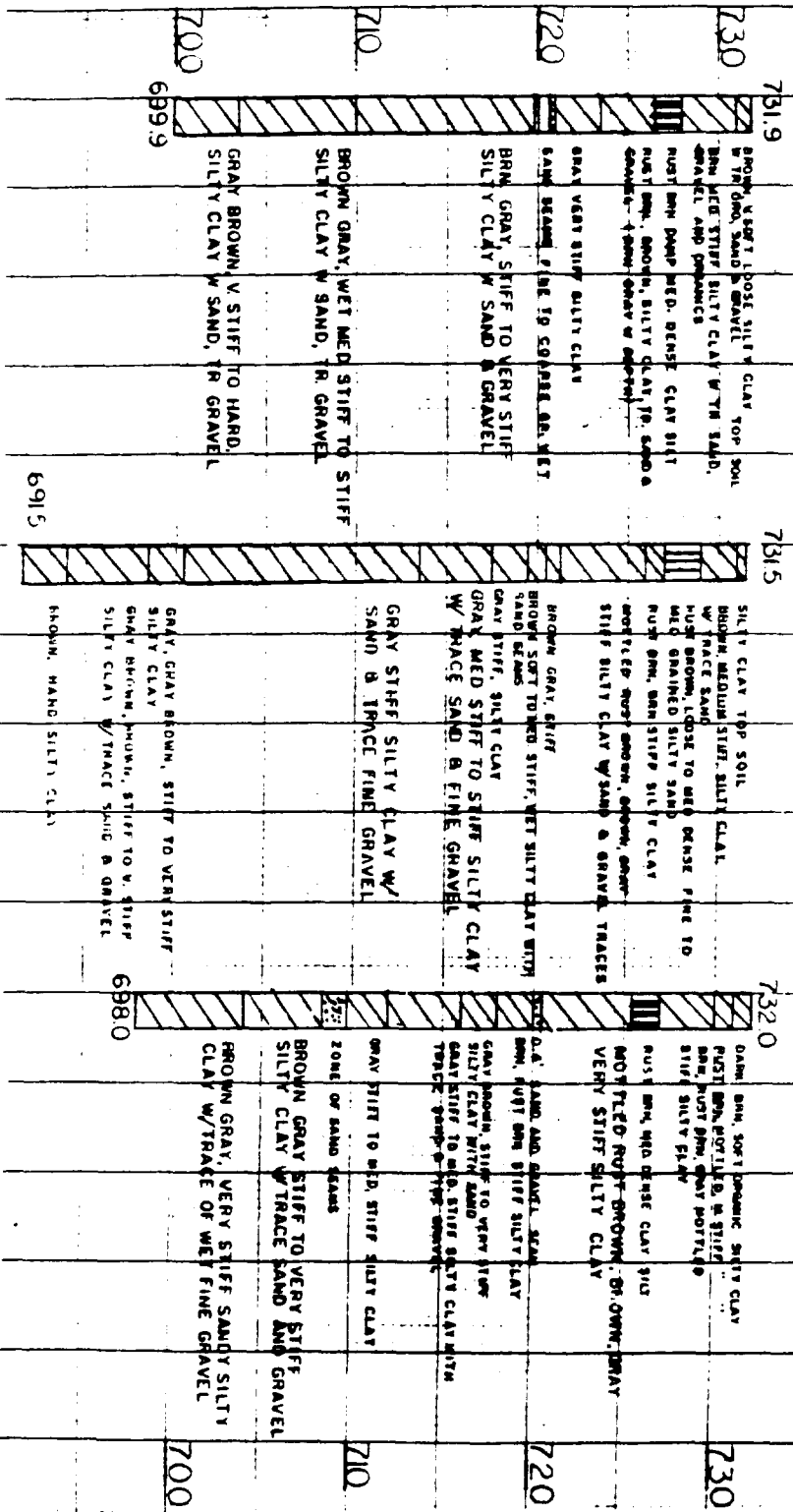
# WAUKEGAN HARBOR CDF SITE SELECTION

SITE 4

4-W-2-83

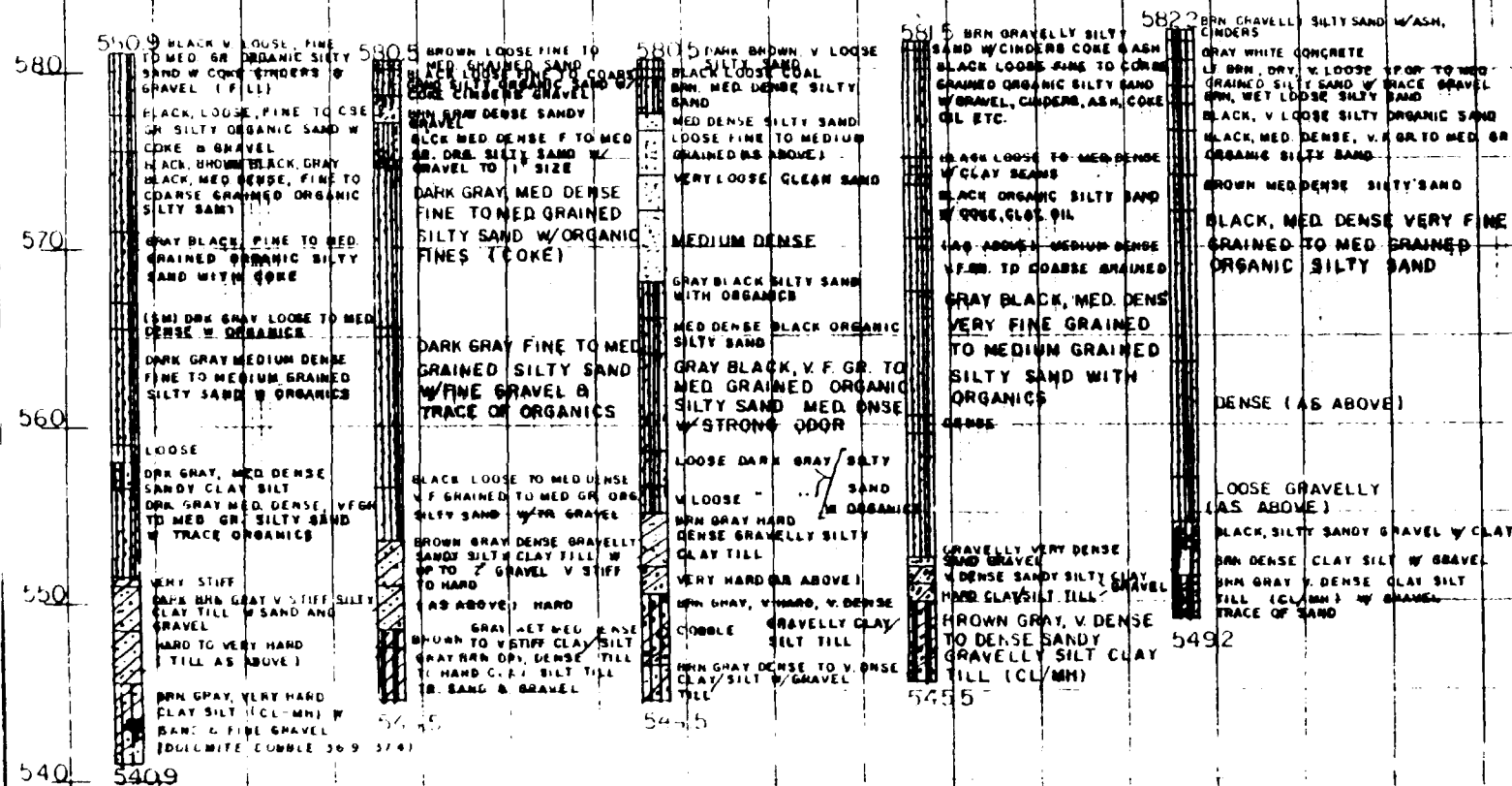
4-W-1-83

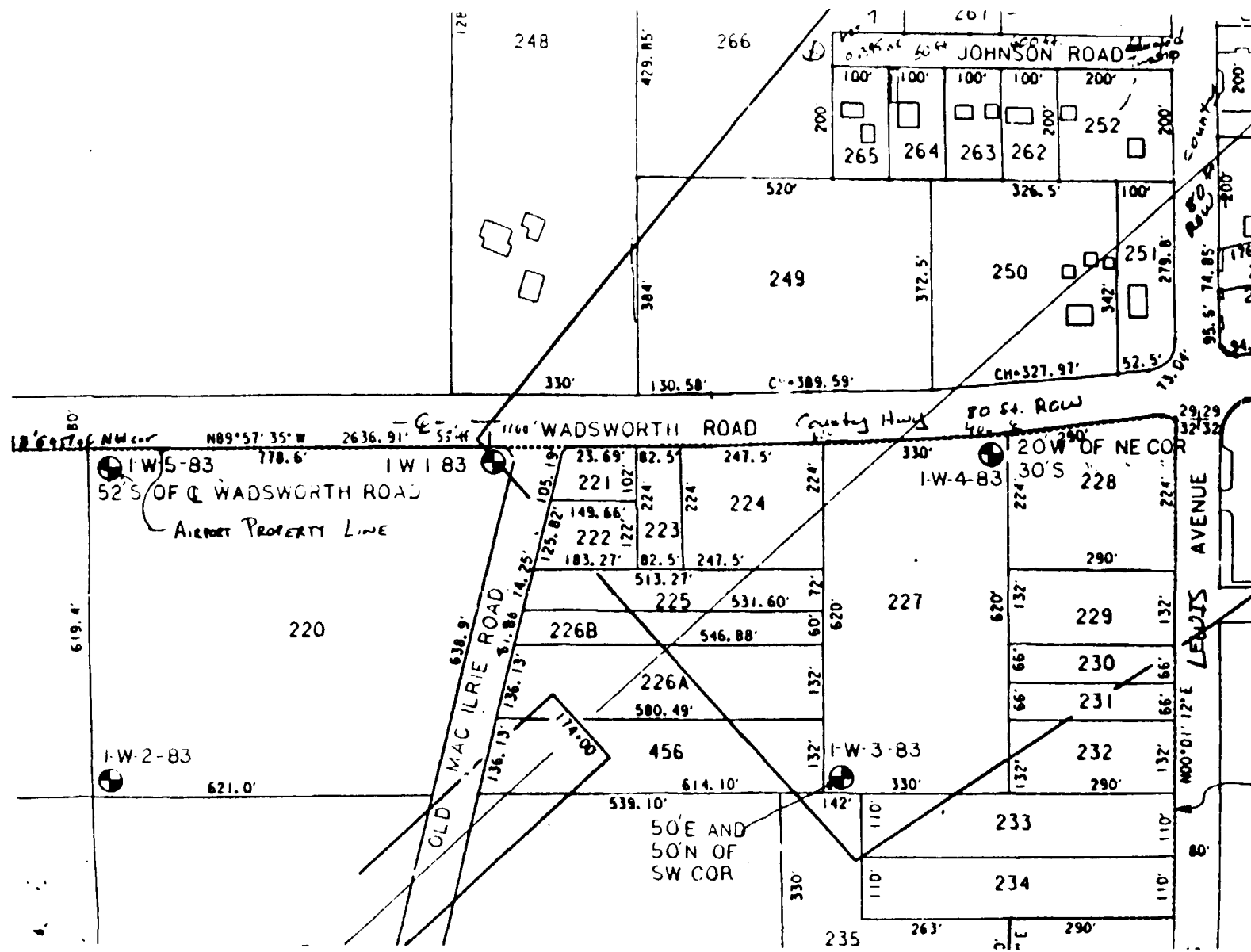
4-W-3-83



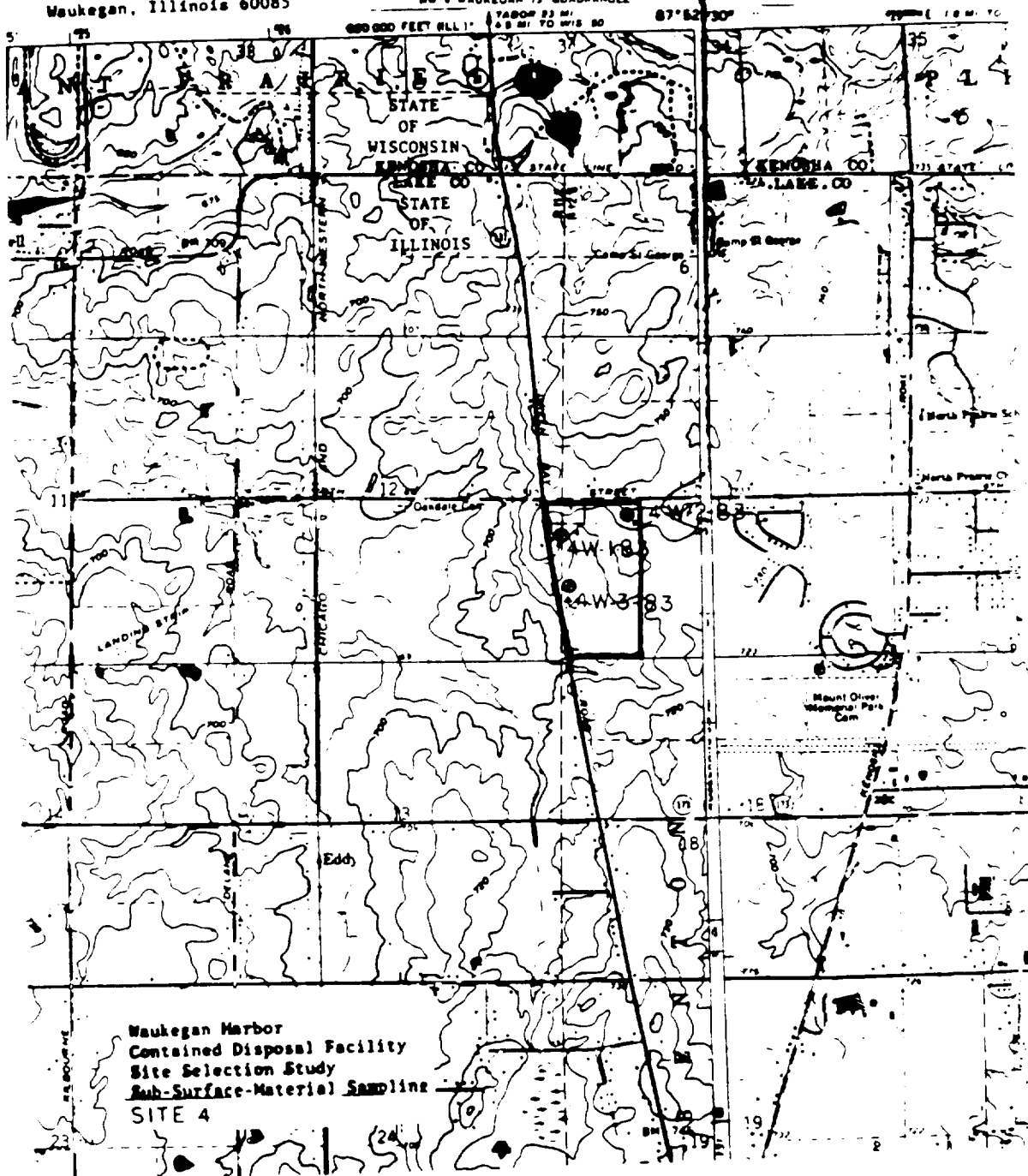
WAUKEGAN HARBOR CDF SITE SELECTION  
SITE 16

6-W-5-83

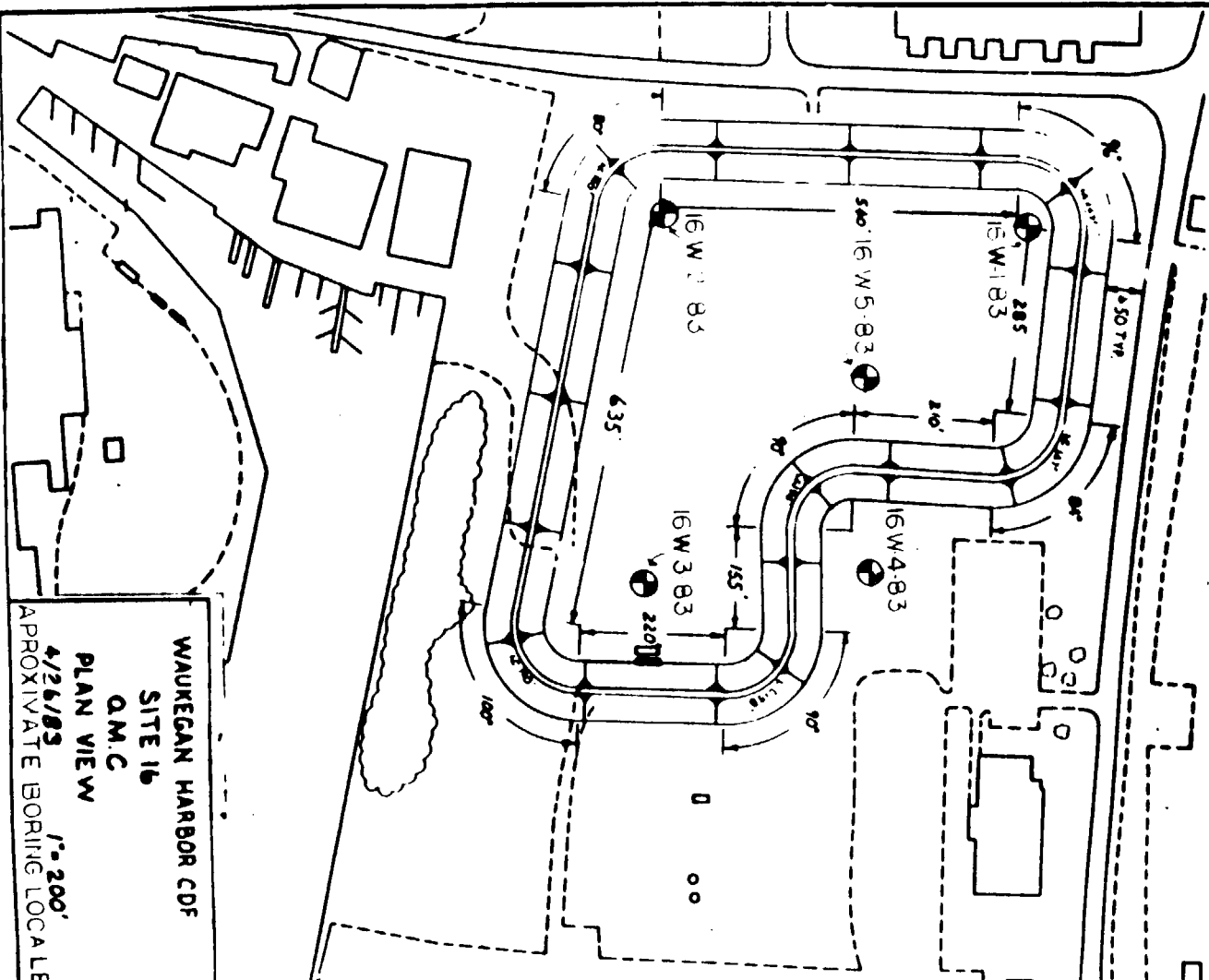
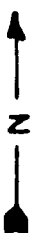




ZION QUADRANGLE  
ILLINOIS-WISCONSIN  
7.5 MINUTE SERIES(TOPOGRAPHIC  
1:250,000) WAUKEGAN 15' QUADRANGLE



VOLUME 76,000 Cu.Yds.  
 PERIMETER 2935 ft. (DIKE &)  
 AREA REQ'D 14.1 Acres  
 DIKE HEIGHT 19.5 ft



WAUKEGAN HARBOR CDF  
 SITE 1b  
 O.M.C.  
 PLAN VIEW  
 4/26/83  
 APPROXIMATE BORING LOCALE

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX D  
PRELIMINARY CDF DESIGNS AND  
COST ESTIMATES

## APPENDIX D

### Preliminary Design and Cost Estimates

1. The CDF design criteria used herein were derived from the USEPA document titled, "RCRA Guidance Document, Landfill Design, Liner System and Final Cover". The design information and cost estimates are preliminary in nature. Provisions for dewatering the dredged material and treating the effluent have not been incorporated into these designs and cost estimates.

2. Site layouts (plans showing the CDF dike alignments) at Sites 1 and 16 are shown on Plates 5 and 6. From the layouts it was determined that a maximum of 14.2 and 15.6 acres can be utilized for CDF construction at Sites 1 and 16, respectively. An important limitation at Site 1 is the finished height of a proposed CDF because it is within a future clear zone of an airport runway. A site layout at Site 4 was not prepared because large scale maps of Site 4 were not available. However, since more than adequate space is available at Site 4 (78 acres), CDF shape, size and height limitations are probably not important considerations.

3. All design data and cost estimates herein are based on a "square shaped" CDF of a particular design capacity. That is, given a design capacity; the area, height and cost were determined based on a square shaped CDF having an area equivalent to the area of the proposed CDF at the site, regardless of its shape. To verify the assumption, the total construction costs of square and non-square CDFs with the same design capacities and areas were computed for several test cases. Variations between the total construction costs of square and non-square CDF's were demonstrated to be on the average, about 3%.

4. The summary tables inclosed make reference to minimum and optimum CDF sizes. The minimum size for a particular design capacity is simply the smallest amount of space (area) that would be needed to construct a CDF of sufficient capacity (volume) to contain the design volume of dredged material. The optimum CDF size refers to the one CDF size (area), out of all possible combinations of area and height, that will contain the design volume and is the least expensive to construct. Also mentioned in the tables is a "CDF which utilizes all available space at a site". This means that the limited area for CDF construction at a site, as determined by the site layouts, was used to define the area of the CDF and the corresponding height and cost were computed based on this area. This was done in some cases because (as in Site 1) the final height of the CDF is a limitation and by utilizing all available area the height could be reduced.

WAUKEGAN HARBOR CDF - ESTIMATED COSTS IN MILLIONS OF DOLLARS (1)

	Design capacity C.Y.	Minimum CDF size required for design capacity			Optimum CDF size determined by minimizing CDF costs (2)			CDF size which utilizes all available space at site		
		CDF (2)	Dredge (3)	Total (4)	CDF (2)	Dredge (3)	Total (4)	CDF (2)	Dredge (3)	Total (4)
SITE 1 14.2 acres	60,000	2.206	.731	3.672	2.119	.731	3.562	3.724	.731	5.569
	163,000	4.488	1.864	7.940	4.151	1.864	7.519	4.237	1.864	7.626
	187,500	4.869	2.134	8.753	4.572	2.134	8.383	4.620	2.134	8.442
	221,000	5.552	2.502	10.068	(5)	(5)	(5)	(5)	(5)	(5)
SITE 4 78 acres	60,000	(6)	(6)	(6)	2.119	.793	3.640	(6)	(6)	(6)
	163,000	(6)	(6)	(6)	4.151	2.029	7.725	(6)	(6)	(6)
	187,500	(6)	(6)	(6)	4.573	2.323	8.620	(6)	(6)	(6)
	221,000	(6)	(6)	(6)	5.122	2.725	9.809	(6)	(6)	(6)
SITE 16 15.6 acres	60,000	2.206	.445	3.327	2.119	.445	3.217	3.724	.455	5.224
	163,000	4.488	1.125	7.015	4.151	1.125	6.594	4.428	1.125	6.940
	187,500	4.869	1.284	7.691	4.573	1.284	7.321	4.635	1.284	7.399
	221,000	5.553	1.502	8.818	5.122	1.502	8.279	(7)	(7)	(7)

(1) Based on a square shaped CDF design. February 1984 Prices.

(2) Cost of CDF construction only.

(3) Includes the cost of dredging and hauling dredged material to the site.

(4) Sum of (2) and (3) plus 25% for contingencies. Does not include land cost, E&D or S&A.

(5) This site does not have sufficient space available for the design capacity.

(6) There are no apparent size or height limitations at this site. Use the optimum CDF size.

(7) Site 16 will probably not accomodate a design volume of 221,000 C.Y. because of its irregular shape.

WAUKEGAN HARBOR CDF - DESIGN DATA (1)  
MINIMUM AND OPTIMUM CDF SIZES

Design capacity (C.Y.)	Minimum CDF size (in acres) required for design capacity		Optimum CDF size determined by minimizing CDF costs (2)	
	Area (acres)	Height (feet)	Area (acres)	Height (feet)
60,000	7.27	25.5	7.49	21.5
163,000	12.75	32.5	13.36	25.5
187,500	13.83	32.5	14.45	26.5
221,000	15.21	34.5	16.15	26.5

(1) Based on a square shaped CDF design.

(2) The cost of CDF construction was minimized. Dredging and hauling costs were not included in the optimization.

WAUKEGAN HARBOR CDF - DESIGN DATA (1)

DESIGNS WHICH UTILIZE ALL AVAILABLE SPACE AT CDF SITES

	Design capacity (C.Y.)	Size (acres)	Height (feet)
SITE 1 14.2 acres	60,000	13.73	12.5
	163,000	14.24	22.5
	187,500	14.11	28.5
	221,000	(2)	(2)

SITE 4. 78 acres. THERE ARE NO APPARENT SIZE OR HEIGHT LIMITATIONS.  
USE OPTIMUM SIZE.

	Design capacity (C.Y.)	Size (acres)	Height (feet)
SITE 16 5.6 acres	60,000	13.73	12.75
	163,000	15.23	23.5
	187,500	15.32	20.5
	221,000	(3)	(3)

(1) Based on a square shaped CDF design.

(2) A minimum of 15.21 acres is required for a design volume of 221,000.

(3) Site 16 will probably not accomodate a design volume of 221,000 C.Y. because of its irregular shape.

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 60000

THICKNESS OF FILL (FEET) = 13

HEIGHT OF CDF (FEET) = 21.5

AREA OF CDF (ACRES) = 7.49

HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	12502	C.Y.	4	50011
DUNE EMBANKMENT FILL	96469	C.Y.	10	964699
CLAY LINER - BOTTOM&SLOPE	12667	C.Y.	11	139346
CLAY - CAP	11734	C.Y.	11	129077
SAND LINER - BOTTOM	5322	C.Y.	18	95797
SAND - CAP	6135	C.Y.	18	110439
TOPSOIL LAYER - SLOPE	2566	C.Y.	5	12831
TOPSOIL LAYER - CAP	12819	C.Y.	10	128197
IMPERV. MEMBRANE - BOTTOM&SLOPE	18656	S.Y.	9	167908
IMPERVIOUS MEMBRANE - CAP	18136	S.Y.	9	163225
FILTER CLOTH - BOTTOM	10747	S.Y.	5	53738
FILTER CLOTH - CAP	19678	S.Y.	5	93394
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				2118666
BIDDING				
MOBILIZATION & DEMOBILIZATION	1	JOB	71000	71000
BIDDINGS (INCLUDING HAULING)	60000	C.Y.	11	660000
SUBTOTAL				731000
TOTAL				2849666
CONTINGENCIES (25%)				712416
GRAND CONSTRUCTION COSTS				3562100

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKESHA HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS A DESIGN UTILIZING ALL AVAILABLE SPACE AT THE CDF SITE.  
 DESIGN CAPACITY (CUBIC YDS) = 60000  
 THICKNESS OF FILL (FEET) = 4  
 HEIGHT OF CDF (FEET) = 12.5  
 AREA OF CDF (ACRES) = 13.73  
 HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	22730	C.Y.	4	90921
DIKE EMBANKMENT FILL	54926	C.Y.	10	549266
CLAY LINER - BOTTOM&SLOPE	33136	C.Y.	11	364497
CLAY - CAP	31721	C.Y.	11	348937
SAND LINER - BOTTOM	21348	C.Y.	18	384278
SAND - CAP	16300	C.Y.	18	293401
TOPSOIL LAYER - SLOPE	2158	C.Y.	5	10793
TOPSOIL LAYER - CAP	33490	C.Y.	10	334906
IMPERV. MEMBRANE - BOTTOM&SLOPE	48846	S.Y.	9	439619
IMPERVIOUS MEMBRANE - CAP	48458	S.Y.	9	436130
FILTER CLOTH - BOTTOM	42904	S.Y.	5	214522
FILTER CLOTH - CAP	49343	S.Y.	5	246717
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				3723992
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	71000	71000
DREDGING (INCLUDING HAULING)	60000	C.Y.	11	660000
SUBTOTAL				731000
TOTAL				4454992
CONTINGENCIES (25%)				1113748
TOTAL CONSTRUCTION COSTS				5568700

# ESTIMATED CGST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 163000

THICKNESS OF FILL (FEET) = 17

HEIGHT OF CDF (FEET) = 25.5

AREA OF CDF (ACRES) = 13.36

HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	22119	C.Y.	4	88479
PILE EMBANKMENT FILL	185365	C.Y.	10	1853653
CLAY LINER - BOTTOM&SLOPE	25163	C.Y.	11	276798
CLAY - CAP	23714	C.Y.	11	260855
SAND LINER - BOTTOM	11416	C.Y.	18	205489
SAND - CAP	12237	C.Y.	18	220270
TOPSOIL LAYER - SLOPE	4128	C.Y.	5	20640
TOPSOIL LAYER - CAP	25246	C.Y.	10	252469
IMPERV. MEMBRANE - BOTTOM&SLOPE	37203	S.Y.	9	334827
IMPERV. MEMBRANE - CAP	36329	S.Y.	9	326966
GEOTEXT. CLOTH - BOTTOM	22993	S.Y.	5	114917
GEOTEXT. CLOTH - CAP	37095	S.Y.	5	185479
4" DIA. PUMP WELLS	4	EA.	2500	10000
SUBTOTAL				4150846
DEMOLITION				
DEMOLITION & DEMOBILIZATION	1	JOB	71000	71000
HAULING (INCLUDING HAULING)	163000	C.Y.	11	1793000
SUBTOTAL				1863999
				6014846
CONTINGENCIES (25%)				1503711
TOTAL CONSTRUCTION COSTS				7519600

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS A DESIGN UTILIZING ALL AVAILABLE SPACE AT THE CDF SITE.  
 DESIGN CAPACITY (CUBIC YDS) = 163000  
 THICKNESS OF FILL (FEET) = 14  
 HEIGHT OF CDF (FEET) = 22.5  
 AREA OF CDF (ACRES) = 14.24  
 HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	23566	C.Y.	4	94265
DUNE EMBANKMENT FILL	155857	C.Y.	10	1558572
CLAY LINER - BOTTOM&SLOPE	28960	C.Y.	11	318568
CLAY - CAP	27443	C.Y.	11	301882
SAND LINER - BOTTOM	14687	C.Y.	18	264391
SAND - CAP	14130	C.Y.	18	254352
TOPSOIL COVER - SLOPE	3819	C.Y.	5	19098
TOPSOIL COVER - CAP	29091	C.Y.	10	290910
IMPERV. MEMBRANE - BOTTOM&SLOPE	42791	S.Y.	9	385124
IMPERV. MEMBRANE - CAP	41981	S.Y.	9	377832
FILTER FORTH - BOTTOM	29547	S.Y.	5	147737
FILTER FORTH - CAP	42804	S.Y.	5	214024
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				4236750
OFFICE EXP.				
APPROVALS & DEMOBILIZATION	1	JOB	71000	71000
HAULING (INCLUDING HAULING)	163000	C.Y.	11	1793000
SUBTOTAL				1864000
TOTAL				6100750
CONTINGENCIES (25%)				1525187
TOTAL CONSTRUCTION COSTS				7625900

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 187500

THICKNESS OF FILL (FEET) = 18

HEIGHT OF CDF (FEET) = 26.5

AREA OF CDF (ACRES) = 14.45

HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	23901	C.Y.	4	95606
DINE EMBANKMENT FILL	207786	C.Y.	10	2077865
CLAY LINER - BOTTOM&SLOPE	27351	C.Y.	11	300866
CLAY - CAP	25814	C.Y.	11	283959
SAND LINER - BOTTOM	12368	C.Y.	18	222628
SAND - CAP	13303	C.Y.	18	239468
TOPSOIL LAYER - SLOPE	4462	C.Y.	5	22313
TOPSOIL LAYER - CAP	27412	C.Y.	10	274126
IMPERV. MEMBRANE - BOTTOM&SLOPE	40461	S.Y.	9	364156
IMPERVIOUS MEMBRANE - CAP	39512	S.Y.	9	355615
FILTER CLOTH - BOTTOM	24893	S.Y.	5	124469
FILTER CLOTH - CAP	40311	S.Y.	5	201559
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				4572635
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	71000	71000
DREDGING (INCLUDING HAULING)	187500	C.Y.	11	2062500
SUBTOTAL				2133500
TOTAL				6706135
CONTINGENCIES (25%)				1676533
TOTAL CONSTRUCTION COSTS				8382700

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 1

SQUARE CDF DESIGN

COMMENT: THIS IS A DESIGN UTILIZING ALL AVAILABLE SPACE AT THE CDF SITE.  
 DESIGN CAPACITY (CUBIC YDS) = 187500  
 THICKNESS OF FILL (FEET) = 20  
 HEIGHT OF CDF (FEET) = 28.5  
 AREA OF CDF (ACRES) = 14.11  
 HAULING DISTANCE (MILES) = 7

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	23356	C.Y.	4	93426
DUNE EMBANKMENT FILL	231269	C.Y.	10	2312695
CLAY LINER - BOTTOM&SLOPE	25498	C.Y.	11	280484
CLAY - CAP	23992	C.Y.	11	263916
SAND LINER - BOTTOM	10682	C.Y.	18	192387
SAND - CAP	12378	C.Y.	18	222815
TOPSOIL LAYER - SLOPE	4612	C.Y.	5	23494
TOPSOIL LAYER - CAP	25534	C.Y.	10	255340
IMPERV. MEMBRANE - BOTTOM&SLOPE	37743	S.Y.	9	339689
IMPERVIOUS MEMBRANE - CAP	36751	S.Y.	9	330762
FILTER CLOTH - BOTTOM	21522	S.Y.	5	107614
FILTER CLOTH - CAP	37522	S.Y.	5	187611
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				4620236
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	71000	71000
DREDGING (INCLUDING HAULING)	187500	C.Y.	11	2062500
SUBTOTAL				2133500
TOTAL				6753736
CONTINGENCIES (25%)				1688434
TOTAL CONSTRUCTION COSTS				8442200

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUNEGAN HARBOR CDF - SITE# 4

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.  
 DESIGN CAPACITY (CUBIC YDS) = 60000  
 THICKNESS OF FILL (FEET) = 13  
 HEIGHT OF CDF (FEET) = 21.5  
 AREA OF CDF (ACRES) = 7.49  
 HAULING DISTANCE (MILES) = 9

QUANTITY DISCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	12502	C.Y.	4	50011
DIKE EMBANKMENT FILL	96469	C.Y.	10	964699
CLAY LINER - BOTTOM&SLOPE	12667	C.Y.	11	139346
CLAY - CAP	11734	C.Y.	11	129077
SAND LINER - BOTTOM	5322	C.Y.	18	95797
SAND - CAP	6135	C.Y.	18	110439
TOPSOIL LAYER - SLOPE	2566	C.Y.	5	12831
TOPSOIL LAYER - CAP	12819	C.Y.	10	128197
IMPERV. MEMBRANE - BOTTOM&SLOPE	18656	S.Y.	9	167908
IMPERVIOUS MEMBRANE - CAP	18136	S.Y.	9	163225
FILTER CLOTH - BOTTOM	10747	S.Y.	5	53738
FILTER CLOTH - CAP	18678	S.Y.	5	93394
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				2118666
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	73000	73000
DREDGING (INCLUDING HAULING)	60000	C.Y.	12	720000
SUBTOTAL				793000
TOTAL				2911666
CONTINGENCIES (25%)				727916
TOTAL CONSTRUCTION COSTS				3639600

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 4

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.  
 DESIGN CAPACITY (CUBIC YDS) = 163000  
 THICKNESS OF FILL (FEET) = 17  
 HEIGHT OF CDF (FEET) = 25.5  
 AREA OF CDF (ACRES) = 13.36  
 HAULING DISTANCE (MILES) = 9

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	22119	C.Y.	4	88479
DINE EMBANKMENT FILL	185365	C.Y.	10	1853653
CLAY LINER - BOTTOM&SLOPE	25163	C.Y.	11	276798
CLAY - CAP	23714	C.Y.	11	260855
SAND LINER - BOTTOM	11416	C.Y.	18	205489
SAND - CAP	12237	C.Y.	18	220270
TOPSOIL LAYER - SLOPE	4128	C.Y.	5	20640
TOPSOIL LAYER - CAP	25246	C.Y.	10	252469
IMPERV. MEMBRANE - BOTTOM&SLOPE	37203	S.Y.	9	334927
IMPERVIOUS MEMBRANE - CAP	36329	S.Y.	9	326966
FILTER CLOTH - BOTTOM	22983	S.Y.	5	114917
FILTER CLOTH - CAP	37095	S.Y.	5	185479
MONITORING WELLS	4	EA.	2500	10000
SUB-TOTAL				4150946
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	73000	73000
DREDGING (INCLUDING HAULING)	163000	C.Y.	12	1956000
SUB-TOTAL				2028999
TOTAL				6179946
CONTINGENCY (25%)				1544986
TOTAL CONSTRUCTION COSTS				7724932

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 16

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 163000

THICKNESS OF FILL (FEET) = 17

HEIGHT OF CDF (FEET) = 25.5

AREA OF CDF (ACRES) = 13.36

HAULING DISTANCE (MILES) = .1

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	22119	C.Y.	4	88479
DIKE EMBANKMENT FILL	185365	C.Y.	10	1853653
CLAY LINER - BOTTOM&SLOPE	25163	C.Y.	11	276798
CLAY - CAP	23714	C.Y.	11	260855
SAND LINER - BOTTOM	11416	C.Y.	18	205489
SAND - CAP	12237	C.Y.	18	220270
TOPSOIL LAYER - SLOPE	4128	C.Y.	5	20640
TOPSOIL LAYER - CAP	25246	C.Y.	10	252469
IMPERV. MEMBRANE - BOTTOM&SLOPE	37207	S.Y.	9	334827
IMPERVIOUS MEMBRANE - CAP	36329	S.Y.	9	326966
FILTER CLOTH - BOTTOM	22983	S.Y.	5	114917
FILTER CLOTH - CAP	37095	S.Y.	5	185479
MONITORING WELLS	4	EA.	2500	10000
GRADIENT				4150846
MOBILIZATION				
MOBILIZATION & DEMOBILIZATION	1	JOB	65000	65000
HAULING (INCLUDING HAULING)	163000	C.Y.	6.5	1059500
SUBTOTAL				1124499
TOTAL				5275346
CONSTRUCTION COSTS				1318836
TOTAL CONSTRUCTION COSTS				6594200

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 16

SQUARE CDF DESIGN

COMMENT: THIS IS A DESIGN UTILIZING ALL AVAILABLE SPACE AT THE CDF SITE.  
 DESIGN CAPACITY (CUBIC YDS) = 163000  
 THICKNESS OF FILL (FEET) = 12  
 HEIGHT OF CDF (FEET) = 20.5  
 AREA OF CDF (ACRES) = 15.23  
 HAULING DISTANCE (MILES) = .1

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	25184	C.Y.	4	100736
DIKE EMBANKMENT FILL	138146	C.Y.	10	1381465
CLAY LINER - BOTTOM&SLOPE	32646	C.Y.	11	359113
CLAY - CAP	31066	C.Y.	11	341726
SAND LINER - BOTTOM	17741	C.Y.	18	319342
SAND - CAP	15967	C.Y.	18	287419
TOPSOIL LAYER - SLOPE	3637	C.Y.	5	18186
TOPSOIL LAYER - CAP	32816	C.Y.	10	328169
IMPERVIOUS MEMBRANE - BOTTOM&SLOPE	48233	S.Y.	9	434102
IMPERVIOUS MEMBRANE - CAP	47466	S.Y.	9	427198
IMPERVIOUS LAYER - BOTTOM	75671	S.Y.	3	178355
IMPERVIOUS LAYER - CAP	49341	S.Y.	3	241709
MONITORING WELLS	4	EA.	2500	10000
SPILL POND				4427528
TOTAL				
DEMOLITION & DEMOBILIZATION	1	JOB	65000	65000
HAULING (INCLUDING HAULING)	163000	C.Y.	6.5	1059500
HAULING				1124500
				5582028
CONSTRUCTION COSTS				1338007
				6940000

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUNEGAN HARBOR CDF - SITE# 16

SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 187500

THICKNESS OF FILL (FEET) = 18

HEIGHT OF CDF (FEET) = 26.5

AREA OF CDF (ACRES) = 14.45

HAULING DISTANCE (MILES) = .1

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	23901	C.Y.	4	95606
DIKE EMBANKMENT FILL	207786	C.Y.	10	2077865
CLAY LINER - BOTTOM&SLOPE	27351	C.Y.	11	300866
CLAY - CAP	25814	C.Y.	11	283959
SAND LINER - BOTTOM	12368	C.Y.	18	222628
SAND - CAP	13303	C.Y.	18	239468
TOPSOIL LAYER - SLOPE	4462	C.Y.	5	22313
TOPSOIL LAYER - CAP	27412	C.Y.	10	274126
IMPERV. MEMBRANE - BOTTOM&SLOPE	40461	S.Y.	9	364156
IMPERVIOUS MEMBRANE - CAP	39512	S.Y.	9	355615
FILTER CLOTH - BOTTOM	24893	S.Y.	5	124469
FILTER CLOTH - CAP	40311	S.Y.	5	201559
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				4572635
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	65000	65000
DREDGING (INCLUDING HAULING)	187500	C.Y.	6.5	1218750
SUBTOTAL				1283750
TOTAL				5856385
CONTINGENCIES (25%)				1464096
TOTAL CONSTRUCTION COSTS				7320500

# ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 16

SQUARE CDF DESIGN

COMMENT: THIS IS A DESIGN UTILIZING ALL AVAILABLE SPACE AT THE CDF SITE.  
 DESIGN CAPACITY (CUBIC YDS) = 187500  
 THICKNESS OF FILL (FEET) = 15  
 HEIGHT OF CDF (FEET) = 23.5  
 AREA OF CDF (ACRES) = 15.32  
 HAULING DISTANCE (MILES) = .1

QUANTITY DISCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	25327	C.Y.	4	101311
DINE EMBANKMENT FILL	175559	C.Y.	10	1755595
CLAY LINER - BOTTOM&SLOPE	31182	C.Y.	11	343012
CLAY - CAP	29582	C.Y.	11	325407
SAND LINER - BOTTOM	15691	C.Y.	18	282442
SAND - CAP	15215	C.Y.	18	273880
TOPSOIL LAYER - SLOPE	4135	C.Y.	5	20679
TOPSOIL LAYER - CAP	31291	C.Y.	10	312917
IMPERV. MEMBRANE - BOTTOM&SLOPE	46103	S.Y.	9	414932
IMPERVIOUS MEMBRANE - CAP	45220	S.Y.	9	406983
FILTER CLOTH - BOTTOM	31559	S.Y.	5	157799
FILTER CLOTH - CAP	46075	S.Y.	5	230375
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				4635337
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	65000	65000
DREDGING (INCLUDING HAULING)	187500	C.Y.	6.5	1218750
SUBTOTAL				1283750
TOTAL				5919087
CONTINGENCIES (25%)				1479771
TOTAL CONSTRUCTION COSTS				7398900

ESTIMATED COST - FEBRUARY 1984 DOLLARS

WAUKEGAN HARBOR CDF - SITE# 16

- SQUARE CDF DESIGN

COMMENT: THIS IS THE OPTIMUM CDF SIZE FOR THIS DESIGN CAPACITY.

DESIGN CAPACITY (CUBIC YDS) = 221000

THICKNESS OF FILL (FEET) = 18

HEIGHT OF CDF (FEET) = 26.5

AREA OF CDF (ACRES) = 16.15

HAULING DISTANCE (MILES) = .1

QUANTITY DESCRIPTION	AMOUNT	UNIT	UNIT PRICE \$	COST \$
DISPOSAL FACILITY				
STRIPPING	26681	C.Y.	4	106726
DIKE EMBANKMENT FILL	222748	C.Y.	10	2227484
CLAY LINER - BOTTOM&SLOPE	31610	C.Y.	11	347714
CLAY - CAP	29940	C.Y.	11	329346
SAND LINER - BOTTOM	14864	C.Y.	18	267563
SAND - CAP	15397	C.Y.	18	277148
TOPSOIL LAYER - SLOPE	4746	C.Y.	5	23734
TOPSOIL LAYER - CAP	31659	C.Y.	10	316599
IMPERV. MEMBRANE - BOTTOM&SLOPE	46781	S.Y.	9	421029
IMPERVIOUS MEMBRANE - CAP	45762	S.Y.	9	411863
FILTER CLOTH - BOTTOM	29901	S.Y.	5	149509
FILTER CLOTH - CAP	46622	S.Y.	5	233111
MONITORING WELLS	4	EA.	2500	10000
SUBTOTAL				5121830
DREDGING				
MOBILIZATION & DEMOBILIZATION	1	JOB	65000	65000
DREDGING (INCLUDING HAULING)	221000	C.Y.	6.5	1436500
SUBTOTAL				1501500
TOTAL				6623330
CONTINGENCIES (25%)				1655832
TOTAL CONSTRUCTION COSTS				8279200

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX E  
ENVIRONMENTAL ASSESMENT BY THE  
CORPS OF ENGINEERS

Preliminary Environmental  
Assessment of Proposed  
Dredged Material Disposal Sites

Waukegan Harbor, Illinois

## INTRODUCTION

Between August 1982 and the present, there have been 15 sites (eleven upland sites and four lake sites) considered for disposal of dredged material from Waukegan Harbor. As a result of inter-agency meetings with the Illinois Department of Transportation's Division of Water Resources, Illinois Environmental Protection Agency, U.S. Environmental Protection Agency, Waukegan Port District, Lake County Planning Commission, and Lake County Health Department, all but 3 upland sites (1, 4, and 16) were eliminated from further consideration. All of the 15 sites are discussed below.

### Alternative Disposal Sites

#### Site 1 - Waukegan Airport Clear Zone

Site 1 is in the SW quarter of Section 29, T46N, R12E, Waukegan, Illinois. The 21-acre site is bounded on the east by Lewis Avenue and on the south by Wadsworth Road. The property is currently owned or in the process of being acquired by the Waukegan Port District for the proposed expansion of the Waukegan Memorial Airport.

#### Physical Resources (Site 1)

The site is relatively high in elevation (680 to 710 feet above sea level) with no ponded or running surface water. Soils are high in clay content with probable low permeation rates and a low water table.

#### Physical Impacts (Site 1)

Site permeability must be investigated to determine leaching potentials and additional groundwater protection needs. Site effluent handling and/or treatment requirements must be evaluated.

#### Vegetation and Wildlife Resources (Site 1)

Site 1 consists of a mixture of habitat types including agricultural fields, early and advanced old fields and a small, old conservation port plantation of pine trees (Pinus sp.). The advanced old field contains perennial forbes, grasses, and scattered elm trees (Ulmas sp.). A small, low, wet patch within the field is vegetated to reed canary grass (Phalarus arundinacea). Residences along two of the site's perimeters are surrounded by mowed lawns and cultivated trees and shrubs. The U.S. Fish and Wildlife Service stated in a 30 August 1983 letter that the wildlife value of the site is fairly high in that it provides some habitat diversity in an area surrounded by urban and agricultural lands.

### Wildlife Impacts--(Site 1)

Conversion of all or part of the site to a confined disposal area would have a significant impact on resident species due to habitat losses. Therefore, destruction of woody vegetation should be avoided where possible. Site capping must be evaluated to prevent entry of contaminants into the food chain.

### Social Setting (Site 1)

Homes are scattered along the site's southern and eastern perimeters but would be removed as part of the proposed extension of the Waukegan Memorial Airport. The area surrounding the site is scattered residential and undeveloped open space.

### Social Impacts (Site 1)

Provided the existing houses are displaced by the airport expansion, no significant social impacts are anticipated. Potential haul routes for dredge material from dredge sites to the disposal site should be mapped to minimize disruptive impacts.

### Cultural Resources (Site 1)

No known archaeological studies have been made at the site.

### Cultural Impacts (Site 1)

Shovel-testing of the site is needed before drawing any conclusions regarding the presence of archaeological or historic resources.

### Site 2 - Waukegan Airport Sanitary Landfill Site

Site 2 is in the NW quarter of Section 32, T46N, R12E, outside the corporate limits of Waukegan, Illinois. The site is approximately 23 acres in size and bounded by Beach Road on the south and McCree Road on the west. The site was used as a modern landfill up until the late 1960's or early 1970's and allegedly leaches lead and arsenic on its northeast corner. On 9 February 1983, this site was eliminated from further consideration based on additional costs needed to repair the present leaching problem at the landfill and the proximity of a school and residential areas.

### Physical Resources (Site 2)

The site, due to landfill operations, is higher than the surrounding area. Due to past use, soil characteristics cannot be evaluated without further testing. There is no ponded or running surface water on the site. Water mains to the Waukegan Memorial Airport (just west of site 2) are being installed, but wells currently supply water to some of the nearby homes and to the school.

### Physical Impacts (Site 2)

Solution(s) to the present leaching problem would have to be implemented. Identification of additional groundwater protection needs would have to be undertaken. Site effluent handling and/or treatment requirements would have to be evaluated.

### Vegetation and Wildlife Resources (Site 2)

The site is primarily vegetated by grasses and scattered perennial forbes, including Queen Ann's lace (*Daucus carota*) and goldenrods (*Solidago* spp.). There are a few, small, unvegetated patches scattered throughout the site.

### Wildlife Impacts (Site 2)

Use of this area would have little effect on wildlife. However, site capping requirements to prevent entry of contaminants into the food chain in the future must be evaluated.

### Social Setting (Site 2)

Beach Park school is east of the site and residential developments are nearby to the east and south.

### Social Impacts (Site 2)

Because of the controversy surrounding the existing landfill, acquiring this site for disposal would probably involve the COE in the existing leaching problem. Potential land routes for dredged material would have to be identified and mapped to minimize disruptive impacts.

### Cultural Resources and Impacts

This site is a modern landfill, now covered in grasses. Construction here would not effect any archaeological or historic resources.

### Site 3 - Kenosha CDF

Site 3 is in the SW quarter of Section 32, T2N, R23N, Kenosha, Wisconsin. The 32 acre site is a COE confined lake disposal area bounded on the north by the south pier of the Federal navigation channel and on the west by American Motors Corporation and the Morelli Export Company properties. The site was eliminated from further consideration at an agency meeting on 19 May 1983 based upon information presented by the COE Detroit District that the Wisconsin DNR would not go along with the disposal of the Waukegan material at Kenosha for environmental reasons.

### Physical Resources (Site 3)

The CDF is a rubble-mound and steel sheet pile structure containing dredged material from the Kenosha navigation channels. Some 1977 water quality monitoring data for inside and outside the CDF is available.

### Physical Impacts (Site 3)

Site design modification may be necessary for the protection of Lake Michigan's water quality. This could include modification or redesign of existing filter cells. Assuming water borne transport of dredged material, there should be no disruptive impacts by the transportation. However, dredge material spillage during rehandling and transport would have to be minimized and monitored.

### Aquatic Resources (Site 3)

The interior of the CDF contains only those benthic organisms that were able to survive dredge disposal operations and are able to survive in the moderately polluted sediments contained in the CDF. The exterior of the CDF provides habitat for snails, mayfly larvae, amphipods, periphytic algae and small fish. The structure is utilized for trout (Salmo spp.), salmon (Oncorhynchus spp.), sunfish (Lepomis spp.) and bass (Micropterus spp.) fishing.

### Aquatic Impacts (Site 3)

Assuming site modifications would assume protection of Lake Michigan's water quality, no significant impacts would be expected.

### Vegetation and Wildlife Resources (Site 3)

The shallow margin between the dredgings and open water within the CDF support some aquatic emergent plants. Raccoon (Procyon lotor) tracks and a few mallards (Anas platyshynchos) were observed in the CDF during a 8 September 1981 field reconnaissance.

### Wildlife Impacts (Site 3)

Site capping to prevent entry of contaminants into the food chain would be a significant project consideration.

### Social Setting (Site 3)

The shoreline in the area of the site consists of Kenosha Harbor, the CDF, the American Motors Corporation, Lake Front Park and private residences. The area encompasses a range of land uses including recreational, residential, industrial and commercial.

### Social Impact (Site 3)

The City of Kenosha would like to see the CDF filled so that it can revert to their use. However, filling the PCB-polluted material may not be readily acceptable to locals.

### Cultural Resources and Impacts

The facility contains no intact or significant archaeological or historical resources.

### Site 4 - Private Land

Site 4 is located in the NW corner of Section 18 and the SW quarter of Section 7 of T46N, R12E, unincorporated Lake County, Illinois. The site is an 80-acre agricultural field bounded by 9th Street on the north, by 17th Street on the south, and by Green Bay Road (Rt. 131) on the west. Zion, the closest community, is to the east.

### Physical Resources

The site is relatively high in elevation (710-730 feet above sea level) with no ponded or running surface water. The area consists of well to moderately well drained deep soils and moderate to moderately slow permeability. Soils are Miami Silt Loam, Montmorenci Silt Loam, Pella Silty Clay Loam, Beecher Silt Loam, Peotone Silty Clay Loam, Barrington Silt Loam, Corwin Silt Loam Grays and Markham Silt Loams, Barrington and Varna Silt Loams and Mundelein and Elliot Silt Loams. The soil appears to be derived from morainal silty clay till with sand and rounded pebbles or gravel. Bedrock is around 500 feet or over 200 feet deep.

#### Physical Impacts (Site 4)

The disposal facility design, including effluent handling or treatment, would have to include measures to assure groundwater protection.

#### Vegetation and Wildlife Resources (Site 4)

Crop field can have value to wildlife as an auxiliary or cold weather food source except that, in this case, there is essentially no interspersation of other habitat types around the site to provide the remainder of their life requirements. For example, deer and raccoon often feed in corn fields but require woods for reproduction. Pheasants too feed in corn but nest in brush and grass often found along fencerows. Some species such as crows and blackbirds will undoubtedly make use of the crop field although they are considered pest species. A few songbirds may make use of the trees found on the site. In total, the U.S Fish and Wildlife Service has rated the site quite low in wildlife value.

#### Wildlife Impacts (Site 4)

Since the site is currently of low value to wildlife, the impact of its use as a disposal site is insignificant. Depending on how the site is reclaimed following use habitat values could actually be increased for a variety of wildlife species.

#### Social Setting (Site 4)

The site is cropland. The surrounding area includes agricultural land, landfills (Browning Ferris and the North Shore Sanitary District), and open space. Zion is the closest community.

#### Social Impacts (Site 4)

Displacement of a farm is the primary social impact foreseen. A determination as to whether the site includes any prime or unique farmland would have to be made in cooperation with other federal and state agencies.

#### Cultural Resources (Site 4)

A cursory examination of the northern portion of the 80-acre site revealed only a few non-cultural fragments of poor quality tan-white chert.

#### Cultural Impacts (Site 4)

Shovel-testing of the site or examination while the surface is exposed after plowing is needed before drawing any conclusions regarding the presence of archaeological or historic resources.

#### Site 5 - North Shore Sanitary Landfill Site

Site 5 is the North Shore Sanitary District Landfill, which is currently being used. It is located in the SE QUARTER OF Section 12, T46N, R11E, in unincorporated Lake County, Illinois. The community of Zion is to the east of the site. The site is bounded on the east by Green Bay Road (Rt. 131) and 9th Street on the north. At the request of the property owner this site has been eliminated from further consideration.

#### Physical Resources and Impacts (Site 5)

Elevations range from 690-710 feet above sea level with bedrock at approximately the 500 foot elevation. The landfill area is covered with silty clay mixed with sand and rounded gravel pebbles. There is no ponded or running surface water on the site. No significant impacts are anticipated as long as groundwater protection needs are met.

#### Wildlife Resources and Impacts (Site 5)

Due to the very low habitat values associated with a landfill, no significant impacts are foreseen.

#### Social Setting and Impacts (Site 5)

The site is somewhat isolated, but a few scattered residences are in the general area. The surrounding area is primarily agricultural and open space. Disposal in the landfill should not cause any significant social problems. Potential haul routes for the dredge material should be mapped to minimize disruptive impacts and assess transport costs.

#### Cultural Resources and Impacts (Site 5)

Because the site is an active sanitary landfill, construction would not affect any cultural resources.

#### Site 6 - Private Waste Disposal Site

Site 6 is a Browning-Ferris Waste Disposal Facility located in the NW 1/2 quarter of Section 7, T46N, R12E, in unincorporated Lake County. The site is near sites 4 and 5 and West of the community of Zion. It is bounded in the South by 9th Street and on the West by Green Bay Road (Rt. 131). The facility generates a heavy flow of truck traffic. This site was eliminated from further consideration because it is not implementable under the Section 123 diked disposal authority. Physical, vegetation and wildlife, and cultural resources, social setting, and impacts for site 6 are the same as described for site 5.

#### Site 7 - Private Waste Disposal Site

Same as Site No. 14

#### Site 8 - COE Chicago Area CDF

Site 8 is the COE's site for the Chicago Area confined lake disposal facility in Calumet Harbor. The 45-acre site is located in the SE quarter of Section 5, T37N, R15E, in Chicago, Illinois adjacent Chicago Port Authority's Iroquois Landing Site. The CDF is currently being constructed to contain dredge material from the Federal navigation channels in the Chicago and Calumet Rivers and harbors. It will be a lined, rubble-mound structure. Further information can be found in the Final Environmental Impact Statement (FEIS) for the CDF construction and dredging. The site was eliminated from further consideration due to insufficient capacity and the facility is not designed for PCB laden material.

#### Site 9 - Waukegan Lake Site

Site 9 is a lake site located in the SW quarter of Section 22 and NW quarter of Section 27, T45N, R12E, in Waukegan, Illinois. The site was eliminated from further consideration at an interagency meeting on 19 May 1983 due to its interruption of the Waukegan River and the inability to meet effluent treatment standards for Lake Michigan.

#### Physical Resources and Impacts (Site 9)

Water depths are 5 to 10 feet along a rubble/riprap, filled shoreline in a deserted industrial area at the mouth of the Waukegan River. The disposal facility design, including effluent handling or treatment, would have to include measures to protect Lake Michigan's water quality.

#### Aquatic Resources (Site 9)

The Waukegan River area, as well as the Waukegan Harbor, has been used as a salmonid stocking area by the Illinois Department of Conservation. The harbor-river area is extensively used by fishermen for trout, salmon, yellow perch and bass. Other fish utilizing the area include alewife (Alosa pseudoharengus), gizzard shad (Dorosoma cepedianum), smelt (Osmerus sp.), goldfish-carp hybrids, white sucker (Catostomus commersoni), and crappie (Pomoxis sp.).

#### Aquatic Impacts (Site 9)

Use of this site would require interruption and/or relocation of the Waukegan River. The Illinois Department of Conservation's salmonid stocking program, the aquatic flora and fauna, and recreational fishing in the Waukegan River would be significantly impacted by long term to permanent loss of aquatic habitats.

#### Wildlife Resources and Impacts (Site 9)

Due to the very low habitat values associated with the site, no significant impacts are foreseen if the site is adequately capped to prevent entry of contaminants into the food chain.

#### Social Setting (Site 9)

The immediate area is largely deserted industrial space, with some railroad tracks and yards still in use. The surrounding area is urban and somewhat depressed.

#### Social Impacts (Site 9)

No major social impacts are foreseen. The location of the site minimizes potential disposal impacts because hauling dredged material to an inland site would not be required.

#### Cultural Resources and Impacts (Site 9)

This site is part of the Waukegan Harbor and has been disturbed by dredging and construction. Disposal here would not affect any cultural resources.

#### Site 10 - Shoreline Site

Site 10 is a shoreline site located in the SW quarter of Section 22 and NW quarter of Section 27, T45N, R12E, in Waukegan, Illinois. The site is adjacent to site 9 and is largely a deserted industrial space, with some railroad tracks and yards still in use. This site was eliminated from further consideration at an interagency meeting on 19 May 1983 due to the stringent limitations it would impose upon future usage and development of the waterfront location.

#### Physical Resources (Site 10)

The site appears to be all fill land. The material on the surface appear to be cinders, slag, gravel, sand, and miscellaneous materials such as brick, concrete and clay.

#### Physical Impacts (Site 10)

The disposal facility design, including effluent handling or treatment, would have to include measures to assure protection of groundwater and Lake Michigan water quality.

#### Aquatic and Wildlife Resources, Social Setting and Impacts (Site 10)

The descriptions and impacts for site 9 regarding aquatics, wildlife and social aspects apply to site 10.

#### Cultural Resources and Impacts (Site 10)

This site is not likely to contain any intact or significant archaeological or historical resources. Therefore, disposal at site 10 would not affect any cultural resources.

#### Site 11 - Greenbelt Forest Preserve Site

Site 11 is in the SE quarter of Section 30, T45N, R12E, Waukegan, Illinois. It is in the Greenbelt Forest which is part of the Lake County Forest Preserve District. It is an old field bounded by Dilger Avenue on the east and 10th Street on the south. At the request of the Lake County Forest Preserve, this site has been eliminated from further consideration.

#### Physical Resources (Site 11)

The area includes about 40 acres and elevations range from 685 to 705 feet M.S.L. This is a natural ground site with rolling open fields and a silty clay soil with sand and gravel derived from till. The soils are Miami Montmorenci Association soils with gently to strongly sloping terrain and moderately well to well drained deep soils with moderate permeability. Bedrock exists at about 560 feet or at a 125' to 145' depth. There is no standing or running surface water on the site.

#### Physical Impacts (Site 11)

The disposal facility design, including effluent handling or treatment, would have to include measures to assure groundwater protection.

#### Vegetation and Wildlife Resources (Site 11)

The site contains the remains of a farmstead (apple trees, road foundations), grasses and perennial forbes which include golden rod, Queen Ann's lace, black-eyed susan (Rudbeckia sp.), sunflower (Helianthus sp.) and yarrow (Achillea millifolium). Within the northern portion of the site is a lower wet area containing seed canary grass and an adjacent cluster of young trees.

#### Wildlife Impacts (Site 11)

No significant problems are anticipated provided the project is closely coordinated with the Lake County Forest Preserve.

#### Social Setting and Impacts (Site 11)

The site is an old agricultural field that is now undeveloped open space with a few scattered trees. It is relatively isolated except for a few scattered houses to the west and a housing development to the east. No major social impacts are foreseen.

#### Cultural Resources and Impacts (Site 11)

As vegetation covers the ground surface, the area should be shovel-tested to determine whether or not archaeological resources are present.

## Site 12 - Lyons Woods Forest Preserve Site

Site 12 is located in the SW quarter of Section 4, T45N, R12E, in unincorporated Lake County, Illinois. The site is in Lyons Woods, a part of the Lake County Forest Preserve District. It is an old field bounded by Blanchard Road on the south and wooded areas on the east and west. At the request of the Lake County Forest Preserve, this site has been eliminated from further consideration.

### Physical Resources (Site 12)

U.S.G.S. quadrangle maps indicate there is a small marsh or wetland in the south central portion of the site that forms the headwaters of an intermittent stream. The stream flows southeast into the wetlands in and adjacent to the Illinois Beach State Park. This is a natural ground site with a clayey silt soil with sand and gravel on the sag plain between the Blodgett and Highland Park Moraines. The 100 acre area encompasses the till plain which is covered by grass and brush with wooded low moraine hills on either side. The soil types are Pella Silty Clay Loam, Ashkum Silty Clay Loam, Beecher Silt Loam, Peotone Silty Clay Loam, wet, Aptakisic Silt Loam, Zurich Silt Loam and Wauconda Silt Loam with slopes of 0 to 4%. The area is isolated and warrants further investigation. Elevations vary from 645 to 675 feet with bedrock around 500' - 550' or 100' to 175' depth.

### Physical Impacts (Site 12)

The disposal facility design, including effluent handling or treatment, would have to include measures to meet ground- and surface-water protection requirements.

### Aquatic Resources and Impacts (Site 12)

No known aquatic information is available on the intermittent stream at this time. Aquatic investigations would be required to determine the extent and significance of the aquatic resources associated with the stream.

### Vegetation and Wildlife Resources (Site 12)

The old field area consists of asters (Aster spp.), theistle (Cirsium sp.), Queen Ann's lace, evening primrose (Oenothera biennis), volunteer grasses and some areas of prairie grasses.

#### Wildlife Impacts (Site 12)

The extent and value of the prairie grasses would need to be determined in order to assess disposal impacts. No significant impacts are anticipated provided the project is closely coordinated with the Lake County Forest Preserve.

#### Social Setting (Site 12)

The site is north of Blanchard Road, Waukegan's northern boundary, in unincorporated Lake County. A residential development and school are south of Blanchard Road. The John S. Clark School is an elementary school with a playground. East of the school is Clark Park, part of the Waukegan Park District.

#### Social Impacts (Site 12)

Access to the site should be at an edge away from the school. Trucking dredged material would cause more of a noise problem than a safety hazard because both the residences and school are opposite Blanchard Road from the site, eliminating a school crossing problem.

#### Cultural Resources and Impacts (Site 12)

The ridge immediately east of site 12 is a more likely location for aboriginal occupation sites. However, site 12 should be shovel-tested to determine whether or not archaeological resources are present.

#### Site 13 - Zion Forest Preserve Site

Site 13 is located in the NW quarter of Section 29 and NE quarter of Section 30, T46N, R12E, in unincorporated Lake County, Illinois. Within the site there are two subareas being considered, 13A and 13B. 13A is in the center of the NE quarter of Section 30 and 13B is in the NE quarter of the NW quarter of Section 29. Site 13 is the part of the Lake County Forest Preserve District referred to as Zion and bounded by 29th Street on the north, Lewis Avenue on the east, 33rd Street on the south and Green Bay Road on the west. At the request of the Lake County Forest Preserve, this site has been eliminated from further consideration.

#### Physical Resources (Site 13)

The site is agricultural land with considerable relief from 750' to 680'. Water filled ditches indicate a high water table and relatively impermeable deep soils. Soil symbols are Houghton Silty Clay, and Markham Silt Loam

with 0 to 12% slopes and deep, well to poorly drained soils. The muck is a very poorly drained organic soil. The site includes an intermittent stream.

#### Physical Impacts (Site 13)

The disposal facility design, including effluent handling or treatment, would have to include measures to meet groundwater surface water protection requirements.

#### Aquatic Resources and Impacts (Site 13)

No known aquatic information is available on the site's intermittent stream at this time. Aquatic investigations would be required to determine the extent and significance of the aquatic resources associated with the stream.

#### Vegetation and Wildlife Resources (Site 13)

The site includes a soybean field, scattered oak-hickory (Quereus spp., Carya spp.) wooded areas, and an intermittent stream.

#### Wildlife Impacts (Site 13)

Avoidance of the wooded areas is recommended because of the wildlife habitat values associated with them.

#### Social Setting (Site 13)

The site is an agricultural field with scattered wooded areas. A few scattered houses with agricultural fields are to the north. The perimeter of site 13 is privately owned and mostly sparsely settled residential. Zion Nuclear Plant is visible to the east.

#### Social Impacts (Site 13)

Potential displacement of farmland is the primary social effect foreseen. Future consideration of site 13 should include a determination of whether it is prime or unique farmland.

#### Cultural Resources (Site 13)

During a field reconnaissance, visibility of the ground surface was excellent despite the soybeans. The highest, central portion of the site was examined briefly; only a few non-cultural fragments of poor-quality white-tan chert were seen.

#### Cultural Impacts (Site 13)

The entire site should be walked (preferably after plowing) to determine whether or not archaeological resources are present.

#### Site 14 - 14th Street Landfill

Site 14 is located in the NW quarter of Section 31, T45N, R12E in North Chicago, Illinois. The site is an old landfill adjacent to 14th Street. It is in a relatively isolated area, with some nearby agricultural fields. A single industrial development is to the South, across 14th Street. A nearby pond to the West was a borrow area for the Skokie Highway (Rt. 41) overpass. The North Shore Sanitary District maintains a pumping station to the North. This site was eliminated from further consideration due to the limited disposal capacities available and the necessity to excavate and dispose of existing landfill material.

#### Physical Resources (Site 14)

Site 14 is higher than the surrounding area and has no ponded or running surface water. Elevations range from 690' to 715' with bedrock from 500 to 550 feet M.S.L. or an overburden depth of 140' to 210'. The soil is disturbed clay till which appears to be transported, permeable and poorly vegetated with sparse grass. Water is puddled in local depressions. Erosion scars showed sand, gravel, slag, brick, wood, cinders, metal and trash under the silty clay with sand and gravel cap. Due to the old land fill which only covers part of the 40 acre site, this site appears less desirable than others visited.

#### Physical Impacts (Site 14)

The permeability of the site's soil would have to be determined and ground-water protection requirements determined for the disposal facility design specifications. Adequate capacity may be a problem due to the height of the existing fill.

#### Vegetation and Wildlife Resources and Impacts (Site 14)

Site 14 is primarily vegetated by grasses. Use of this site would have little effect on wildlife. However, site capping requirements to prevent entry of contaminants into the food chain in the future must be evaluated.

#### Social Setting and Impacts (Site 14)

The site is in a relatively isolated area, with some nearby agricultural fields. A single industrial development is to the south across 14th Street. No major social impacts are foreseen.

#### Cultural Resources and Impacts (Site 14)

The site is an old landfill, now covered with grass. Construction would not affect any cultural resources.

#### Site 15 - Waukegan Airport Between Runways

Site 15 is located in the east half of Section 31 and NW quarter of Section 32, T46N, R12E, Waukegan, Illinois. The site is between the existing and proposed northeast-southwest paved runways at the Waukegan Memorial Airport. The site is presently a grass covered, clear zone. This site was eliminated from further consideration due to the limitations on disposal capacity and probable interruption of existing utilities.

#### Physical Resources (Site 15)

There are two small ponds in the area of the site which will be relocated further away from the site as part of the airport expansion project. Soils are high in clay content with probable low permeation rates and a low water table.

#### Physical Impacts (Site 15)

The permeability of the site's soils would have to be determined and groundwater protection requirements determined for this disposal facility design specifications.

#### Vegetation and Wildlife Resources (Site 15)

The site is presently grass covered and has very little habitat value due to the proximity to the airport runway.

#### wildlife Impacts (Site 15)

There would be a potential aviation hazard with birds that are usually attracted by landfill and dredged material disposal sites.

#### Aquatic Resources and Impacts (Site 15)

No significant impacts are anticipated since the two ponds are not natural and would be relocated as part of the airport extension project.

#### Cultural Resources and Impacts (Site 15)

The site should be shovel-tested to determine whether or not cultural resources are present.

#### Site 16 - Outboard Marine Corp (OMC) Site

Site 16 is located in the NE quarter of Section 22, T45N, R12E, Waukegan, Illinois. The site lies adjacent to and between Waukegan Harbor and Lake Michigan. Although owned by OMC, it apparently sits idle or is used for temporary storage of materials.

#### Physical Resources (Site 16)

The predevelopment terrain consisted of coastal dunes with a marsh or swampy area underlying a bluff which represents a lake terrace or former shoreline of ancient Lake Michigan. The surface soils are aeolian dune sands generally very fine to fine grained overlying transgressing beach sands which are fine to coarse grained. The dune sands are very loose to medium dense while the beach sand is loose to dense.

#### Physical Impacts (Site 16)

The permeability of the site's soils would have to be determined and groundwater protection requirements determined for the disposal facility design specifications.

#### Vegetation and Wildlife Resources (Site 16)

Site 16 is characterized by being flat with no standing or running water and is vegetated by a variety of weedy grass and forb species which are periodically mowed. It is of low value to wildlife although it does provide some food and cover for various birds and small mammals.

### Wildlife Impacts

The use of the site for dredge disposal would have little impact on wildlife resources.

### Social Setting (Site 16)

The site is in an industrial area north of the Waukegan Harbor entrance. A waterworks facility is between the site and the entrance to the federal channel. Further north beyond the site is a waste treatment plant. A public beach and beach house are along the Lake Michigan shoreline to the east, but are separated from site 16 by a harbor access road.

### Social Impacts (Site 16)

It should be possible to minimize or avoid disturbing the beach area during dredging and disposal operations. No significant social impacts are anticipated from disposal, but future development of the site may be affected.

### Cultural Resources and Impacts (Site 16)

Borings taken in June 1983 show that the site consists of modern fill (slag and gravel) to a depth between five and twelve feet. The site has been graded flat; it is not likely to contain intact or significant archaeological or historical resources.

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX F  
PLANNING AID LETTER FROM U.S.  
FISH AND WILDLIFE



## United States Department of the Interior

FISH AND WILDLIFE SERVICE

ROCK ISLAND FIELD OFFICE (ES)

1830 Second Avenue, Second Floor

Rock Island, Illinois 61201

IN REPLY REFER TO:

Commercial: 309-793-5800

FTS: 386-5800

August 30, 1983

Lt. Colonel Christos A. Dovas  
District Engineer  
U.S. Army Engineer District  
Chicago  
219 South Dearborn Street  
Chicago, Illinois 60604

Dear Colonel Dovas:

This constitutes our Planning Aid Letter on four sites proposed for the potential disposal of contaminated materials from Waukegan Harbor, Waukegan, Illinois. It has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It is submitted for use in your planning process and for inclusion in your Site Selection Report. A copy has been sent to the Illinois Department of Conservation and any comments they may have will be forwarded upon receipt.

At this writing, the number of potential disposal sites under consideration has been reduced to four. The selected site will be used for the permanent disposal of PCB contaminated sediments from the federally maintained channel in Waukegan Harbor. We are assuming that the design of the confined disposal site will be adequate in terms of size and protection of ground water resources. The site will be capped with two feet of clay, one foot of sand, a filter cloth and a final two feet of top soil. The following is a description of the fish and wildlife resources of each of the four potential disposal sites and an evaluation of project impacts on them.

### Site Descriptions and Expected Impacts

#### Site 1 - Waukegan Airport Clear Zone

This 78 acre site is located in the SW 1/4 of Section 29, T46N, R12E, bounded by Wadsworth Road on the south and Lewis Avenue on the east. It is triangular in shape and has been designated for purchase as a clear zone in conjunction with expansion of the Waukegan Memorial Airport. Several residences are located on the site which would be removed in the event of airport expansion.

The site contains no standing or running water. It consists of a mixture of habitat types including agricultural fields, early and advanced old fields and a small plantation of pine trees. The advanced old field consists of a

variety of perennial forbs and grasses with invasion by elm trees (Ulm sp.) and shrubs such as sumac (Rhus sp.). The residences are surrounded by mowed lawns and cultivated trees and shrubs.

The wildlife value of the site is fairly high in that it provides some habitat diversity in an area surrounded by urban and agricultural lands. Such species as deer, fox, woodchucks, rabbits, skunks, voles, shrews, mice, pheasants and a variety of songbirds may utilize the site. Raptors such as the rough-legged hawk, red-tailed hawk, broad-winged hawk and sparrow hawk may use the site for hunting. The pine plantation would attract morning doves, chickadees, grosbeaks, blue jays, juncos, nuthatches, goldfinches, siskins, brown thrashers, warblers and titmice. The lack of permanent water on the site makes it unsuitable for waterfowl, marsh and shorebirds or aquatic mammals such as beaver, raccoon and muskrat.

Project Impacts - The conversion of all or part of this site to a confined disposal site will have a significant adverse impact on the resident species of the site and their habitat. It will have a lesser adverse impact on migratory or transient species as there is probably similar habitat in the vicinity that they could utilize. Depending on how the site revegetated following use, some of the lost habitat value can be reclaimed.

#### Site 4 - Private Land

This 80 acre site is located in the SW 1/4 of Section 7 and NW 1/4 of Section 18, T46N, R12E and is bounded by Green Bay Road (Rte. 131) on the west, Ninth Street on the north and Seventeenth Street on the south. It consists of agricultural land currently in corn with a few trees and shrubs located along fencelines. It has no standing or running water.

Crop field can have value to wildlife as an auxiliary or cold weather food source except that, in this case, there is essentially no interspersions of other habitat types around the site to provide the remainder of their life requirements. For example, deer and raccoon often feed in corn fields but require woods for reproduction. Pheasants too feed in corn but nest in brush and grass often found along fencerows. Some species such as crows and blackbirds will undoubtedly make use of the crop field although they are considered pest species. A few songbirds may make use of the trees found on the site. In total, we would rate the site quite low in wildlife value.

Project Impacts - Since the site is currently of low value to wildlife, the impact of its use as a disposal site is insignificant. Depending on how the site is reclaimed following use habitat values could actually be increased for a variety of wildlife species.

#### Site 6 - Browning Ferris, Inc. Landfill

The site is located in the NW 1/4 of Section 7, R12E, T46N and is bounded by Green Bay Road (Rte. 131) as the west and Ninth Street on the south. It is in a continual state of disturbance due to landfilling activities and there is little or no wildlife value on the site. There is no standing or running water.

Project Impacts - Since the site is currently of no value to wildlife, there will be no impact due to its use as a disposal site. Depending on how the site is reclaimed following use, some habitat value could be created for a variety of wildlife species.

#### Site 16 - Outboard Marine Corporation

This site lies adjacent to Waukegan Harbor between it and Lake Michigan west of Seahorse Drive. It is characterized by being flat with no standing or running water and is vegetated by a variety of weedy grass and forb species which are periodically mowed. It is of low value to wildlife although does provide some food and cover for various birds and small mammals. Although owned by OMC, it apparently sits idle or is used for temporary storage of materials.

Project Impacts - Use of this site would have little impact on fish and wildlife resources. Following use, some habitat development could take place although the proximity to an industrial area would limit its use by many wildlife species.

#### Ranking of Alternatives

This Service would have no objection to the use of any of the four sites for confined disposal of dredged materials. However, we do have a preference in the following order:

- 1) Site 6 - Browning Ferris Landfill
- 2) Site 16 - OMC
- 3) Site 4 - Private Land
- 4) Site 1 - Airport Clear Zone

This preference is based upon the current habitat value, expected impacts, and potential for mitigation or enhancement following use.

#### Mitigation

The Services' Mitigation Policy provides for mitigation recommendations based upon the perceived value and scarcity of the habitat in question. The habitat types are placed in one of four categories, each with a different mitigation goal.

We would categorize the habitats of the four sites as follows:

<u>Habitat Type</u>	<u>Resource Category</u>	<u>Site</u>
Cultivated	4	1, 4
Early Old Field	3	1
Advanced Old Field	3	1
Pine Plantation	3	1
Mowed	4	1, 16
Wooded	3	4

Note that we do not consider Site 6 as habitat because it is continually being disturbed or will be disturbed during landfilling operations.

Only Site 1 would necessitate mitigation of project impacts. The mitigation goal for Resource Category 3 is "no net loss of habitat value" with compensation either in or out of kind. This could be accomplished by planting a variety of tree, shrub and forb species that would be beneficial to wildlife. The existing pine plantation and advanced old field should be avoided if at all possible to reduce the impacts on this site. Furthermore, a small depression or water catchment could be designed into the final site design to provide some semipermanent water for wildlife species.

At the other three sites, post-project habitat development would be a form of enhancement of wildlife values. The Corps might consider this as a form a "mitigation banking" wherein habitat values can be accumulated and then, at a later time and in a different location, this "account" can be drawn upon for another project where mitigation opportunities do not exist or they are inadequate to compensate for anticipated losses. We have enclosed some additional information on the subject of mitigation banking. If it looks like a concept that the Corps might wish to pursue in this case, we would be most happy to discuss it further.

Sincerely,



Thomas M. Groutage  
Field Supervisor

cc: IDOC (Lutz)

WAUKEGAN HARBOR, ILLINOIS  
CONFINED DREDGE DISPOSAL FACILITY  
SITE SELECTION STUDY  
APPENDIX G  
LETTER FROM U.S. EPA ON STATUS OF  
25% WAIVER



SEP 26 1983

UNITED STATES  
ENVIRONMENTAL PROTECTION AGENCY  
REGION V  
230 SOUTH DEARBORN ST.  
CHICAGO, ILLINOIS 60604

27/9  
J  
25  
72  
REPLY TO ATTENTION OF

Colonel Christos A. Dovas, P.E.  
District Engineer  
Chicago District, Corps of Engineers  
219 South Dearborn Street  
Chicago, Illinois 60604

Dear Colonel Dovas:

Your letter of August 11, 1983, asked us to determine the eligibility of a local sponsor at Waukegan Harbor, Illinois, to receive a waiver of the 25 percent cost sharing provision of Section 123 of Public Law 91-611. Eligibility allows the Secretary of the Army to waive the 25 percent non-Federal contribution toward costs for the construction of contained dredged soil disposal facilities in the Great Lakes and connecting channels. The waiver may be granted if the area in which construction will take place is "in compliance with an approved plan for the general geographical area of the dredging activity for construction, modification, expansion or rehabilitation of waste treatment facilities", and the Environmental Protection Agency's (EPA) Administrator has found that applicable water quality standards are not being violated. The EPA has determined the foregoing to be met when the geographical area in question has a certified and approved Water Quality Management Plan, and when major dischargers in the area are in compliance with their National Pollutant Discharge Elimination System (NPDES) permits.

We have determined that the Waukegan Harbor area is covered by a certified and approved Water Quality Management Plan. With respect to the compliance of major dischargers with their NPDES permits, we have determined that there are three major dischargers in the general geographical area, and they are in compliance with their NPDES permits; therefore, applicable water quality standards are not being violated.

I trust the above response will prove adequate for your decisionmaking regarding the eligibility of the local sponsor for a waiver of the cost sharing requirements for the Waukegan Harbor project. If you have any questions about our review, please call Mr. James Hooper of the Environmental Review Branch, at 886-6694.

Sincerely yours,

Alan Levin  
Acting Regional Administrator

**D**



DEPARTMENT OF THE ARMY  
CHICAGO DISTRICT CORPS OF ENGINEERS  
219 SOUTH DEARBORN STREET  
CHICAGO, ILLINOIS 60604-1797

REPLY TO  
ATTENTION OF:

20 SEP 1984

Plan Formulation Branch

Mr. Hugh Thomas  
Secretary & Assoc. General Couns  
Outboard Marine Corporation  
100 Sea Horse Drive  
Waukegan, Illinois 60085

Dear Mr. Thomas:

I am requesting your review and comments regarding the recommendation for deauthorization of the Waukegan Harbor, Illinois Project, modification authorized by House Resolution dated 17 December 1970 and Senate Resolution dated 8 December 1970 under Section 201 of PL 89-298. The resolutions were based on House Document No. 368, 90th Congress, 2d Session, 26 July 1968.

The enabling legislation for deauthorization is provided by Section 12, Public Law 93-251, as amended by Section 157, PL 94-587.

The Project has not been funded and is now being recommended for deauthorization because the project lacks net benefits, and it is apparent that a restudy would not develop a justified plan.

I have enclosed an information paper on the subject Project for your information. If you have any questions or would like to discuss any aspect further, please call my point of contact, Ms. Barbara Williams, at 312/353-0330.

The subject study program was not selected by the State of Illinois and registered with the Office of Management and Budget for coordination under the procedures of the Executive Order 12372 on Intergovernmental Review of Federal Programs, dated July 14, 1983. Hence, the normal coordination procedures are being followed, with comments and responses being sent directly to the Chicago District.

If you would care to comment on the proposed deauthorization, I would appreciate a reply by October 5, 1984.

Sincerely,

Frank R. Finch, P.E.  
LTC, Corps of Engineers  
District Engineer

Enclosure

SEP 27 1984 REC'D

DEPARTMENT OF THE ARMY  
CHICAGO DISTRICT, CORPS OF ENGINEERS  
219 SOUTH DEARBORN STREET  
CHICAGO, ILLINOIS 60604

D R A F T

10 September 1984

DEAUTHORIZATION OF CORPS OF ENGINEERS PROJECT:  
WAUKEGAN HARBOR, ILLINOIS PROJECT MODIFICATION

DEAUTHORIZATION AUTHORITY

1. Authority. Deauthorization authority is provided by Section 12 of Public Law 93-251 as amended by Section 157, PL 94-587, which requires that the Congress annually be provided a list of unconstructed Corps of Engineers projects which no longer are considered appropriate for continued authorization. Congressional criterion for consideration for deauthorization action is that the project has been authorized for a period of at least eight years without any congressional appropriations within the last eight years.

AUTHORIZATION OF SUBJECT PROJECT

2. Authority. The subject project, which is limited to modification of the existing (as of 1970) Waukegan Harbor, Illinois, was authorized by House Resolution dated 17 December 1970 and Senate Resolution No. 91-1422, dated 8 December 1970 under authority of PL 89-298, Section 201 of 27 October 1965, based on House Document No. 368/90/2, dated 26 July 1968.

3. Prior authorizations at the Waukegan Harbor, Illinois, site are listed below:

R&H Act of 14 June 1880  
R&H Act of 3 Aug 1882  
PL No. 56, Chapt 1079, 13 June 1902  
PL 71-520, 3 July 1930  
PL 79-14, 2 March 1945

DESCRIPTION OF PROJECT

4. General. Waukegan Harbor is located in the city of Waukegan, Illinois, on the west shore of Lake Michigan, 16 miles south of Kenosha Harbor, Wisconsin, and 38 miles north of Chicago Harbor, Illinois. Federal improvements at Waukegan Harbor consist of a protected entrance channel and an inner basin. Local interests maintain a channel extending northward from the inner basin, with two mooring slips branching off the west side of the

channel. There are no bridges across any of the harbor channels. Water levels in the harbor are affected by surface fluctuations of Lake Michigan which have ranged from a high monthly mean stage of 5.14 feet above to 1.45 feet below low-water datum. Wind and barometric pressure variations cause temporary fluctuations up to 3 feet.

5. Project Purpose, Description (See map attachment 1). The harbor improvements of the authorized plan were to have resulted in transportation savings on deep-draft commerce. The project provides for deepening the existing entrance channel in the outer harbor from 22 feet to 25 feet and extending it to the depth in Lake Michigan, at widths varying from 380 feet to 500 feet; deepening the channel between piers from 18 feet to a depth of 23 feet at a width of 180 feet; and deepening the inner basin from 18 feet to 23 feet and extending its limits approximately 275 feet northward.

6. Economic Analysis:

Original Analysis

Costs (interest rate of 3-1/4%, 50-year life):

Federal first cost:	\$ 1,198,000
Non-Federal first cost:	753,000

Total	1,951,000
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<u>Annual maintenance:</u>	20,200
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Benefit-Cost Ratio:

Benefits	\$ 217,400
Costs	99,700
B/C ratio	2.2

C. Deauthorization Savings (Federal):

Authorized Federal Project costs (July 84 prices)	\$ 4,699,200
Sunk costs (Federal) to date (actual)	0
Estimated Federal Deauthorization Costs (funding, if any, required to restore to pre-authorization state)	0

7. Status of Project:

In 1972, the subject Waukegan Harbor Project Modification was placed in the inactive category because the Project was no longer economically justified, based on the prescribed evaluation of Civil Works projects. The local sponsor, the Waukegan Port District, agreed with the action in the attached letter, dated 4 December 1974 (attachment 2).

WATERBORNE COMMERCE

8. The anticipated benefits in the authorized project were based on unit transportation savings on prospective commerce in gypsum rock, bulk

building cement, and overseas general cargo. The savings are assessed on the increase in cement and overseas general cargo tonnage that would result from the authorized deepening and extension of Waukegan Harbor channels by allowing the vessels to be loaded to a full safe draft of 21 feet.

9. Benefits also were based on an anticipated need resulting from an increase in waterborne commerce at Waukegan Harbor. The 1968 authorizing document contained the following figures for tonnage at the Harbor:

<u>Years</u>	<u>Total Tonnage</u>	<u>Comment</u>
1949 - 1958	82,326	Actual, Average/yr
1959 - 1965	360,472	Actual, Average/yr
1966 - 2015	540,000	Estimated, Average/yr

10. The actual total tonnage for the Waukegan Harbor for the years 1966-1983 and estimated tonnage for 1984 are given below.

<u>Years</u>	<u>Total Tonnage</u>	<u>Comment</u>
1949 - 1958	533,340 <u>1/</u>	Actual, Average/yr
1971 - 1975	486,420 <u>1/</u>	Actual, Average/yr
1976 - 1980	423,450 <u>1/</u>	Actual, Average/yr
1981	211,049 <u>1/</u>	Actual, Total/yr
1982	114,033 <u>2/</u>	Actual, Total/yr
1983	195,180 <u>3/</u>	Actual, Total/yr
1984	+ 270,000 <u>3/</u>	Estimated, Total/yr

1/ Source: Dept. of Army, USACE, Waterborne Commerce Part 3, 1966-1982.

2/ Source: Personal communication, B. Adamczyk, National Gypsum,  
20 Aug 84.

3/ Source: Personal communication, T. Davies, Huron Cement Co., 21 Aug 84.

11. Future of Waterborne Commerce. The outlook for waterborne commerce at Waukegan Harbor indicates that total tonnage will remain approximately as it is at present, unless there is a significant shift in the National economy, according to present commercial users of subject harbor.

#### COORDINATION

12. The subject study program was not selected by the State of Illinois and registered with the Office of Management and Budget for coordination under the procedures of the Executive Order 12372 on Intergovernmental Review of Federal Programs, dated July 14, 1983. Hence, the normal coordination procedures are being followed, with comments and responses being sent directly to the Chicago District.

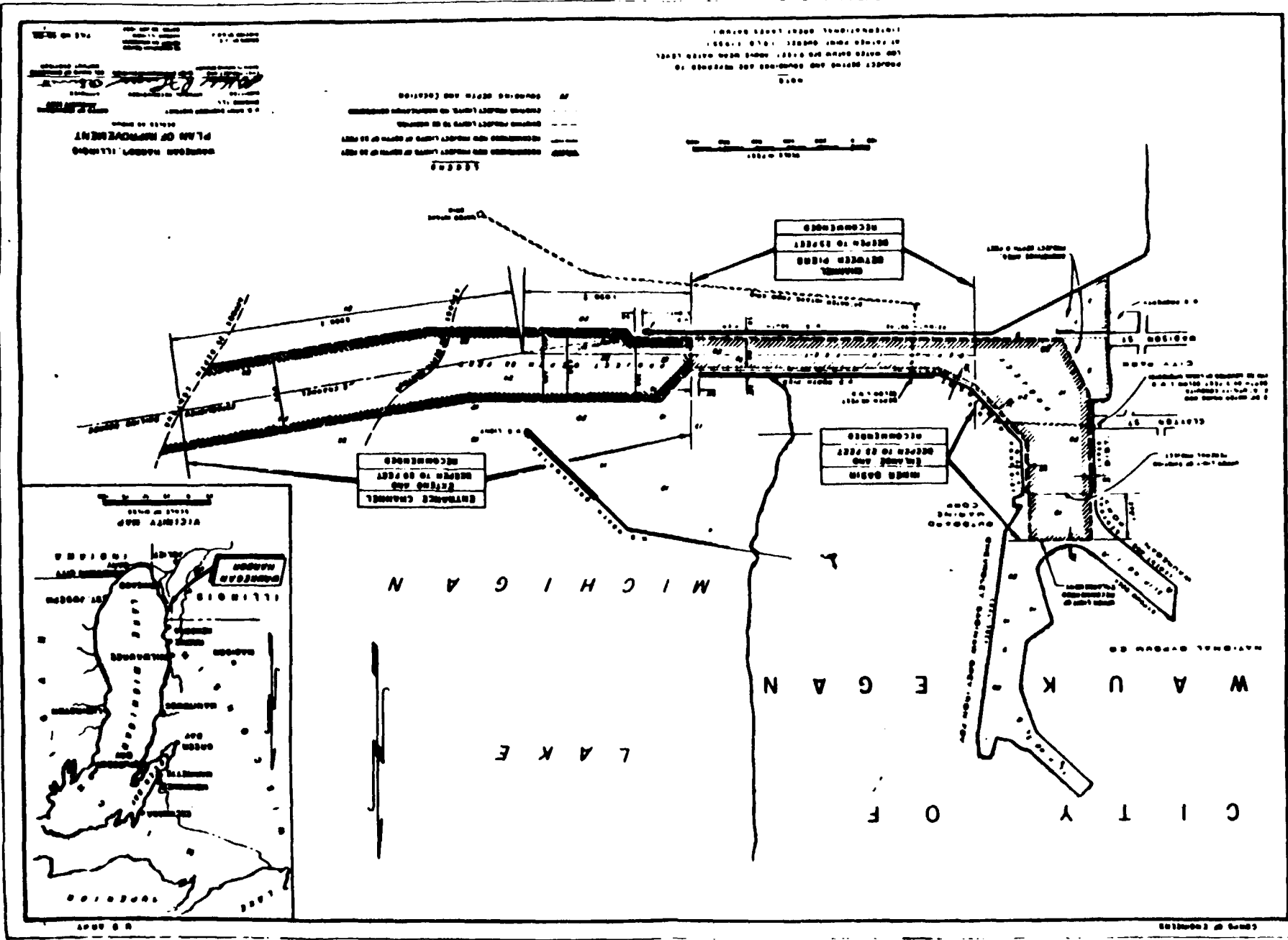
The correspondence and distribution list are included as attachment 3. Comments received will be included as attachment 4.

# RECOMMENDATION

13. I recommend that the subject project, which is limited to modification of the existing Waukegan Harbor, Illinois, based on House Document No. 368/90/2, dated 26 July 1968, be deauthorized because the projected water-borne commerce tonnage needed to economically justify the authorized channel deepening has not been developed, and it is apparent that a restudy would not develop a justified plan at this time.

4 attachments

FRANK R. FINCH, P.E.  
LTC, Corps of Engineers  
District Engineer



PHONE: 822-8820  
EA CODE: 312

## WAUKEGAN PORT DISTRICT

BEACH & MEARKE ROADS  
3800 N. MEARKE ROAD  
WAUKEGAN, ILLINOIS 60085



December 4, 1972

MICHAEL T. KOSYLANSKI, MANAGER  
LEWIS D. CLARKE, GENERAL ATTORNEY  
801 WEST WASHINGTON STREET  
WAUKEGAN, ILLINOIS

MILTON J. LARSEN  
HARBOR MASTER

Richard M. Wells  
Colonel, Corps of Engineers  
District Engineer  
Department of the Army  
Chicago District, Corps of Engineers  
219 South Dearborn Street  
Chicago, Illinois 60604

Dear Colonel Wells:

Mr. Joseph L. Rayniak, Chairman of the Board of the Waukegan Port District, has asked me to reply to your letter of November 21, 1972. Your letter related to deepening the existing entrance channel and the inner harbor at Waukegan.

Your letter has been reviewed and the Port District Board agrees that the project is now uneconomical and should be reclassified.

Sincerely yours,

Lewis D. Clarke

LDC:sp

RICHARD OGILVIE, GOVERNOR  
STATE OF ILLINOIS

ROBERT SABONJIAN, MAYOR  
WAUKEGAN, ILLINOIS

### BOARD MEMBERS

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EXEC. VICE PRESIDENT  
OUTBOARD MARINE CORP.  
WAUKEGAN, ILLINOIS

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RICHARD P. KENNEDY  
ASSOCIATE PUBLISHER  
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115 MADISON STREET  
WAUKEGAN, ILLINOIS

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ROBERT P. O'MEARA  
PRESIDENT  
CITIZENS NATIONAL BANK  
814 WASHINGTON STREET  
WAUKEGAN, ILLINOIS

#### TREASURER

ELWYN F. WIGHTMAN, C.L.U.  
INSURANCE  
SUITE 400  
88 NORTH COUNTY STREET  
WAUKEGAN, ILLINOIS

#### DIRECTOR

GEORGE E. BATZEL  
PRESIDENT  
MIDLAND DIVISION  
THE DEXTER CORPORATION  
EAST WATER STREET  
WAUKEGAN, ILLINOIS

Attachment 2

This letter was sent to the following:

Honorable Bill Morris, Mayor  
City of Waukegan  
106 N. Utica Street  
Waukegan, Illinois 60085

Mr. Thomas Oliver, Chairman  
Lake Michigan Shoreline Advisory Committee  
Village of Lake Bluff  
40 East Center Avenue  
Lake Bluff, Illinois 60044

Mr. Don Vonnahme, Director  
Division of Water Resources  
Department of Transportation  
2300 South Dirksen Parkway  
Springfield, Illinois 62764

Commander  
9th Coast Guard District  
1240 East 9th Street  
Cleveland, Ohio 44199-2002

Mr. Thomas E. Vick, Director  
Community Development and Enforcement  
City of Waukegan  
106 North Utica Street  
Waukegan, Illinois 60085

Mr. Hugh Thomas  
Secretary & Assoc. General Counsel  
Outboard Marine Corporation  
100 Sea Horse Drive  
Waukegan, Illinois

Honorable Alan Dixon  
United States Senator  
230 S. Dearborn Street  
Room 3996  
Chicago, Illinois 60604

Honorable Charles H. Percy  
United States Senator  
230 S. Dearborn Street  
Chicago, Illinois 60604

Honorable John Porter  
Representative in Congress  
104 Wilmot Road - Suite 410  
Deerfield, Illinois 60015

Honorable John S. Matijevich  
House of Representatives  
226 North Utica  
Waukegan, Illinois 60085

Mr. Lane Kendig, Director  
Planning, Zoning & Environmental  
Quality  
Lake County Regional Planning  
Commission  
18 North County Street, Rm A803  
County Building  
Waukegan, Illinois 60085

Larsen Marine Service, Inc.  
625 Sea Horse Drive  
Waukegan, Illinois 60085

National Gypsum  
P.O. Box 139  
515 Sea Horse Drive  
Waukegan, Illinois 60085

Falcon Marine  
P.O. Box 84  
Waukegan, Illinois 60085

Mr. Tom Davies, Manager  
Huron Cement Co.  
315 Sea Horse Drive  
Waukegan, Illinois 60085

Mr. Donald Freeborn,  
Executive Director  
Waukegan Port District  
3500 N. McAree Road  
Waukegan, Illinois 60087

Richard Carlson, Director  
Illinois Environmental  
Protection Agency  
2200 Churchill Road  
Springfield, Illinois 62706

Mr. Glen Miller, Chairman  
Lake County Board of Commissioners  
18 North County Street  
Waukegan, Illinois 60085

Honorable Adeline Jay Geo-Karis  
Illinois Senate District #31  
P.O. Box 33  
Zion, Illinois 60099

COMMENTS RECEIVED'  
(To be added when received)

*Attachment 4*

Minutes of Technical Issues  
Presented by OMC Representatives  
to EPA and Illinois Representatives  
on September 30, 1986

Effects of the ROD

Roger reviewed the impacts of just the construction of the remedial plan. We mentioned five points. Construction would severely impact the worldwide data processing center; IBM personnel have advised OMC that the vibrations could have an effect on the computers. The dust problem would probably not be able to be handled by the existing equipment. Second, the worldwide research engineering center could be affected (both physically and psychologically) by volatilization from the lagoons and contractors in level C protective gear. Third, the diecasting facility makes parts that cannot be made anywhere else. The air intake to this diecasting facility is adjacent to the dewatering lagoon. Roger said he expected to be in existence for more than two years - perhaps five years or longer. Fourth is the perception of having a "level C zone" right in the midst of the manufacturing area. If there is not in fact exposure, there still is the perception of exposure. Roger stated our concern about union members continuing to stay on the job. I then pointed out - and specifically mentioned it as being at your request - OMC's concerns with potential suits by "citizens". These could include unions, employees, neighbors, beach users, and others. Roger summed up by asking the question that had to be asked by OMC management: "Can OMC take the risk of shutdown?" These are real risks that have an unaffordable effect if they occur.

We were asked only one question concerning the impacts on OMC: "Whether the water intake could be solved?" Roger indicated that if that were the only issue, we could work out an alternative supply (assuming there was one available which was a necessity).

Roger then discussed the impacts upon harbor uses. He noted the increased boating uses in the Harbor, the repeated requests by the Port District and the City to develop this area for public uses, that the lagoon system will forego development of that property for many, many years and that Larsen would be substantially affected.

John Herbich then reviewed our dredging concerns. He pointed out that whichever of a variety of dredging technologies were used (whether small cutterhead, clamshell or other) that approximately 13% of the PCBs in Slip 3 would be left behind. This means that a total of from 38 to 42,000 pounds of PCBs would be missed by any dredge. He also stated that the dredging would result in higher PCBs being at the top of the sediment layer than now. He noted that at present "very little" of the PCBs moved, and that even in a 100 year storm only a small amount of PCBs are resuspended. With dredging, however, he stated that burrows or ridges would be left by whatever technology is used. In a response from a question from Charles Rogers, he noted that there were other dredges in Japan. He had reviewed them, but that they were not available in this country.

Herbich then reviewed sediment resuspension. He stated that a substantial amount of sediment will be resuspended by dredging, even with the lowest cutterhead speed, over 2,000 pounds of PCBs would be suspended. Even more PCBs would be resuspended with a clamshell, which would resuspend over 12,000 pounds. The major resuspension with a clamshell dredge is the need to drop the clamshell into the bottom in order to remove the material. Herbich calculated that 63% of the resuspended PCBs would settle in forty days assuming still water and no wind. Over 4,000 days would be required (with still water and no wind) for 77% of the material to settle. In other words, the PCBs would not completely settle out and that the silt curtains - which were indicated - would have to remain in place for a very long period of time. He noted that silt curtains are fragile and that - in the event of a water level drop such as with a storm. A differential of two or three feet might result which would tear the silt curtains releasing PCBs in the water column to the Harbor.

Herbich also noted that there were a variety of losses that could occur, including leaks and pipe joints. Jim Frank of IEPA asked Herbich one question concerning the need for dredging of the upper Harbor. Herbich responded that there did not appear to be any major problem now.

#### EPA Goals and Criteria

The first "question" was our comment that the 50 ppm action level appeared to be not based upon any technical requirements, but historical. EPA appeared to agree with that assessment. With respect to the 10,000 ppm areas, EPA indicated they were fairly comfortable with the boundaries of those areas based upon existing samples. They appear to have no real concept of a technical basis for treating the

10,000 ppm material differently than others, other than a subjective judgment that those materials, being liquid, require special attention before they could be transported. Canonie (Phil Antommara) and Roger raised the question whether or not the concern was based upon an apparent diffusiveness of the PCBs into the clay. Antommara stated that this was contrary to the other experiences of Canonie where PCBs did not migrate into clay. Roger noted that it was also contrary to the Fisher, Petty & Lick study done on Slip 3 sediments which showed virtually no diffusion. EPA promised to get back to us on the basis for the 10,000 ppm criteria.

EPA also stated that the reason for fixating any material above 500 ppm appeared to be related to transportation requirements. They did not know that fixation of any material (including the material over 10,000 ppm) was to minimize volatilization. Antommara noted that Region IV had agreed to stabilize PCBs as a treatment method and to leave those materials onsite even over a sole source aquifer in Florida.

The discussion then moved into several design questions raised by Canonie. Antommara asked if dredging is required, how will you measure completion? He suggested that the only way to measure it is to establish a criteria of the number of passes required, providing EPA supervision during those activities, and that that was sufficient performance. In regard to volatilization, he noted serious concerns for the lagoons proximity to other areas and a general need to minimize excavation at any particular time. In response to another question by Antommara, Caplice confirmed that they would have to agree in advance to define the specific areas for activity. This is a significant concept in that it may get us away from a "action level" approach and into a geographic approach.

There was additional discussion of the need to protect sheet piling. EPA was unaware of any riprap to support sheet piling. They also appear to be unaware of the problems that Canonie and Herbich expect in dredging near the base of sheet piling - which is related to the fact that sheet piling appears not to have driven into the clay, but is held in place by sand within the Harbor. We also asked whether or not anyone could get a slurry wall to go five feet into the glacial till.

Roger Crawford then summarized the major design issues. Is fixation required for material handling reasons rather than to prevent volatilization? How is the 10,000 ppm criteria set? Is the release from the proposed operation to be considered in the same manner that the no action alternative is considered and that a risk assessment might be necessary. And multiple handling should be avoided, to avoid additional risks and costs.

### "Alternative Technologies"

The discussion then shifted into alternative technologies. Roger stated that OMC would like to see any technology, including stabilization, considered. He stated our opinion that none of these alternative technologies were now demonstrated. He noted particularly with incineration as well as with other "alternative technologies", that if the material could be packaged (dredged, dewatered and prepared for treatment) there were still major material handling problems for incineration. Phil Antommara confirmed a concern that one would make bricks by incinerating the material.

Roger then asked what technologies would the Agency "feel good about". Charles Rogers noted that EPA had just completed a study on sediment treatment approaches. He said it was too early in the research and development stage to focus on a particular method. He indicated that he was surprised at the option that the Record of Decision was offered to OMC (he thought that the lagoons were a bad approach). His study is looking at incineration, chemical oxidation, inplace extraction processes, and stabilization. At the present time, he believes that fixation is a cost-effective approach. He said that incineration is much too costly for sediments, and has the problem of the "occlusion" that was mentioned by Phil Antommara. He stated that of the nine methods that had been preliminarily identified for review, that they expected to reduce the list to three alternatives for study for the next fiscal year (which begins October 1). Those three would be "developed" within the next year.

At this point, Bill Child, Director of the Land Pollution Division of IEPA, requested that incineration of Slip 3 materials remain on the table under consideration to be a separate operable unit. Dan Boyd responded that he was concerned about complete incineration, and that in light of the material handling problems it would be much more difficult to assure adequate combustion and avoidance of the partial combustion by-products of PCBs (i.e. dioxin and furans). Roger, responding to Bill Child, said that we had taken IEPA's overtures this spring very seriously; however, we thought incineration was very expensive and that we did not want to be the "guinea pig" for demonstration. Roger continued that, regardless of alternatives, OMC would be looking at material handling and releases and asking whether there would be any gain from the remedial action. He noted that risk is related to material handling issues.

E

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